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CLAIMS

[Claim(s)]
[Claim 1] The user input section which is an authoring system for supporting creation and edit of the behavior of the multi-joint structure, and receives the command inputted through an actuation screen from a user, and data, The user presentation section which offers the workplace for creating and editing the behavior of said other joint structure to a user on an actuation screen, The authoring system characterized by forming the connection relation of the components of behavior based on the user input on an actuation screen, and providing the program generation section which generates the program which specifies behavior.
[Claim 2] The component of behavior is an authoring system according to claim 1 characterized by including the group who combined action and two or more actions, branching, and termination.
[Claim 3] Action is an authoring system according to claim 2 characterized by including the motion data which described serial actuation of each joint of the multi-joint structure.
[Claim 4] Action is an authoring system according to claim 2 characterized by including the sound data by which a voice output is carried out to playback of action synchronizing with a time amount target.
[Claim 5] Action is an authoring system according to claim 2 characterized by including the indicator indicative data which described burning/dissipation actuation of a display indicator by which a display output is carried out to playback of action synchronizing with a time amount target.
[Claim 6] Said user presentation section is an authoring system according to claim 1 characterized by showing the connection relation between each component of behavior in a flow chart edit format.
[Claim 7] Said user presentation section is an authoring system according to claim 1 characterized by providing a user with the attribute setting-out screen which sets up attribute information with each detailed component of behavior.
[Claim 8] The user input step which is the authoring approach for supporting creation and edit of the behavior of the multi-joint structure, and receives the command inputted through an actuation screen from a user, and data, The user presentation step which offers the workplace for creating and editing the behavior of said other joint structure to a user on an actuation screen, The authoring approach characterized by forming the connection relation of the components of behavior based on the user input on an actuation screen, and providing the program generation step which generates the program which specifies

behavior.
[Claim 9] The component of behavior is the authoring approach according to claim 8 characterized by including the group who combined action and two or more actions, branching, and termination.
[Claim 10] Action is the authoring approach according to claim 9 characterized by including the motion data which described serial actuation of each joint of the multi-joint structure.
[Claim 11] Action is the authoring approach according to claim 9 characterized by including the sound data by which a voice output is carried out to playback of action synchronizing with a time amount target.
[Claim 12] Action is the authoring approach according to claim 9 characterized by including the indicator indicative data which described burning/dissipation actuation of a display indicator by which a display output is carried out to playback of action synchronizing with a time amount target.
[Claim 13] The authoring approach according to claim 8 characterized by showing the connection relation between each component of behavior in a flow chart edit format at said user presentation step.
[Claim 14] The authoring approach according to claim 8 characterized by providing a user with the attribute setting-out screen which sets up attribute information with each detailed component of behavior at said user presentation step.
[Claim 15] It is the storage which stored physically the computer software described to perform processing for supporting creation and edit of the behavior of the multi-joint structure on computer system in the computer-readable format. The user input step which receives the command into which said computer software is inputted through an actuation screen from a user, and data, The user presentation step which offers the workplace for creating and editing the behavior of said other joint structure to a user on an actuation screen, The storage characterized by forming the connection relation of the components of behavior based on the user input on an actuation screen, and providing the program generation step which generates the program which specifies behavior.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the authoring system and the authoring

approach for supporting creation and edit of the data according to a predetermined scenario, and relates to the authoring system and the authoring approach of supporting creation and edit of a series of command/data which describe a robot's predetermined pattern of operation especially.

[0002] Furthermore, this invention relates to the authoring system and the authoring approach of supporting creation and edit of a pattern of operation using the set of the components which specify a robot's operating state in detail. While components-izing actions of the robot which consists of combination of one or more time series data, such as actuation of each joint actuator, and arranging on a computer display especially It is related with the authoring system and the authoring approach of performing creation and edit of a robot's behavior by specifying the joint relation of each action by GUI actuation on a display.

[0003]

[Description of the Prior Art] The thing of the machinery which performs motion modeled on actuation of human being using the electric or magnetic operation is called "robot." It is said that a robot's origin of a word originates in ROBOTA (slave machine) of a slab word. Although it was in our country that a robot began to spread from the end of the 1960s, the many were the industrial robots (industrial robot) in works aiming at automation, full automation, etc. of production, such as a manipulator and a carrier robot.

[0004] Recently, the researches and developments about the structure of leg formula mobile robots, such as a robot (humanoid robot) of "the human form" which imitated the body mechanism of the animal which performs 2-pair-of-shoes walks in erect posture, such as a pet mold robot which imitated the body mechanism of the animal of quadrapedalism and its actuation like a dog or a cat or Homo sapiens, and an ape, and actuation, or "a human mold", or its stable walk control progress, and the expectation for utilization has also been growing. although these leg formula mobile robot compares with a crawler type robot, it is unstable and attitude control and walk control become difficult -- rise and fall of a stairway and an obstruction -- getting over -- etc. -- it excels in the point that flexible walk / transit actuation is realizable.

[0005] Like an arm type robot, the robot of a deferment type which is implanted and used for a certain specific location works only in fixed and local workspaces, such as assembly, a sorting activity, etc. of components. On the other hand, the robot of workspace of a portable type is un-restrictive, and he can move free in a predetermined path or non-path top, and the human activity of predetermined or arbitration can be executed by proxy, or he can offer the various services which replace Homo sapiens, a dog, or other life objects.

[0006] As one of the applications of a leg formula mobile robot, vicarious execution of various kinds of difficulty activities in an industrial activity, a production activity, etc. is mentioned. For example, it is vicarious execution of the maintenance in a nuclear power plant, a thermal power station plant, and a petrochemical plant, conveyance and assembly operation of the components in a plant, cleaning in a skyscraper, and the risk activity and difficulty activity like the rescue in a fire site and others etc.

[0007] Moreover, the application of "symbiosis" or "entertainment" of a life adhesion mold, i.e., human being, is mentioned rather than above-mentioned activity exchange as other applications of a leg formula mobile robot. This kind of robot emulates the rich feeling expression using the mechanisms of operation and the limbs of a leg formula

ambulatory exercise with comparatively high intelligence, such as Homo sapiens or a dog (pet). Moreover, it is also required that the lively response expression which it not only performs faithfully the pattern of operation inputted beforehand, but corresponded dynamically to a partner's language and attitudes ("it strikes") should be realized. ["it praises" or "he scolding",]

[0008] The conventional toy machine has the fixed relation between user actuation and response actuation, and cannot change actuation of a toy according to liking of a user. Consequently, a user becomes ********** soon about the toy which repeats only the same actuation.

[0009] On the other hand, the intelligent robot has the behavioral model and learning model resulting from actuation, and realizes autonomous thinking and motion control by changing a model based on input, such as voice from the outside, and an image, a tactile sense, and opting for actuation. When a robot prepares a feeling model and an instinct model, the autonomous action according to a robot's own feeling and instinct can be expressed. Moreover, when a robot equips a picture input device and voice-input/output equipment and performs image recognition processing and speech recognition processing, it also becomes possible to realize realistic communication with human being on more advanced intellectual level.

[0010] Moreover, by answering having detected the stimulus from the outside, such as user actuation, and changing this model, namely, giving the "study effectiveness", or it does not get bored for a user, the pattern of operation which was adapted for liking can be offered.

[0011] The leg formula mobile robot of these days has high information processing capacity, and can regard the robot itself as a kind of computing system. Therefore, the altitude and a series of complicated operating sequences which are constituted by the combination of the pattern of operation realized on a robot or two or more fundamental patterns of operation are built according to the same activity as computer programming.

[0012] Moreover, a robot's diffusion rate will increase increasingly from now on, and it will be expected that a robot permeates deeply not only the industrial world but ordinary homes and everyday life. About the product which pursues entertainment nature, it is especially expected [that a consuming public layer without advanced information about a computer or computer programming purchases and uses a robot in many cases, and].

[0013] Therefore, it is thought desirable to offer the tool for supporting creating and editing a robot's operating sequence comparatively easily and efficiently by interactive processing also for such a general user, i.e., an authoring system.

[0014]

[Problem(s) to be Solved by the Invention] The object of this invention is to offer the outstanding authoring system and the outstanding authoring approach of supporting creation and edit of the data according to a predetermined scenario.

[0015] The further object of this invention is to offer the outstanding authoring system and the outstanding authoring approach of supporting creation and edit of a series of command/data which describe the predetermined pattern of the multi-joint structures, such as a robot, of operation.

[0016] The further object of this invention is to offer the outstanding authoring system and the outstanding authoring approach of supporting creation and edit of a pattern of operation using the set of the components which specify a robot's operating state.

[0017] The further object of this invention is to offer the outstanding authoring system and the outstanding authoring approach of performing creation and edit of a robot's behavior by specifying the joint relation of each action by GUI actuation on a display while it components-izes actions of the robot which consists of combination of one or more time series data, such as actuation of each joint actuator, and arranges them on a computer display.
[0018]
[Means for Solving the Problem and its Function] This invention is made in consideration of the above-mentioned technical problem. The 1st side face The user input section or the step which is the authoring system or approach for supporting creation and edit of the behavior of the multi-joint structure, and receives the command inputted through an actuation screen from a user, and data, The user presentation section or the step which offers the workplace for creating and editing the behavior of said other joint structure to a user on an actuation screen, It is the authoring system or approach characterized by forming the connection relation of the components of behavior based on the user input on an actuation screen, and providing the program generation section or the step which generates the program which specifies behavior.
[0019] However, it does not especially ask whether the "system" said here means the thing of an object which gathered logically, and two or more equipments (or functional module which realizes a specific function) are in a case with single each equipment and functional module.
[0020] Moreover, the group who combined action and two or more actions, branching, and termination can be included in the component of behavior.
[0021] Moreover, action is constituted by combining the motion data which described serial actuation of each joint of the multi-joint structure, the sound data by which a voice output is carried out to playback of action synchronizing with a time amount target, and the indicator indicative data which described burning/dissipation actuation of a display indicator by which a display output is carried out to playback of action synchronizing with a time amount target synchronous on a time-axis.
[0022] While according to the authoring system or approach concerning the 1st side face of this invention components-izing action and arranging on a computer display, specifying the joint relation of each action by GUI actuation on a display can perform creation and edit of a robot's behavior with the sensation of a flow chart editor. Moreover, behavior can include the playback sequence of action, and conditional branching and a loop formation.
[0023] Even if the information about a program is the user of the general ******** company funeral which is not deep by showing the connection relation between each component of behavior in a flow chart edit format, said user presentation section or step can follow GUI menu manipulation, and can create and edit behavior comparatively easily.
[0024] You may make it said user presentation section or step provide a user with the attribute setting-out screen which sets up attribute information with each detailed component of behavior.
[0025] Moreover, the 2nd side face of this invention is the storage which stored physically the computer software described to perform processing for supporting creation and edit of the behavior of the multi-joint structure on computer system in the computer-

readable format. The user input step which receives the command into which said computer software is inputted through an actuation screen from a user, and data, The user presentation step which offers the workplace for creating and editing the behavior of said other joint structure to a user on an actuation screen, It is the storage characterized by forming the connection relation of the components of behavior based on the user input on an actuation screen, and providing the program generation step which generates the program which specifies behavior.

[0026] The storage concerning the 2nd side face of this invention is a medium which offers computer software physically in a computer-readable format to the computer system of the versatility which can perform various program codes, for example. Attachment and detachment of CD (Compact Disc), FD (Floppy Disc), MO (Magneto-Optical disc), etc., etc. are free for such a medium, and it is a storage of portability. Or it is also technically possible to provide specific computer system with computer software in a computer-readable format via transmission media, such as a network (for a network not to ask distinction of wireless and a cable), etc.

[0027] Such a storage defines the collaboration-relation on the structure of the computer software and the storage for realizing the function of computer software predetermined in a computer system top, or a function. If it puts in another way, by installing predetermined computer software in computer system through the storage concerning the 2nd side face of this invention, on computer system, a collaboration-operation is demonstrated and the same operation effectiveness as the authoring system and the authoring approach concerning the 1st side face of this invention can be acquired.

[0028] The object, the description, and advantage of further others of this invention will become [rather than] clear by detailed explanation based on the example and the drawing to attach of this invention mentioned later.

[0029]

[Embodiment of the Invention] Hereafter, the example of this invention is explained in detail, referring to a drawing.

[0030] A. The appearance configuration of the mobile robot 1 which performs the leg formula walk by the limbs with which operation is presented in this invention is shown in a robot's block diagram 1 . This robot 1 is a mobile robot of the multi-joint mold constituted by using as a model the configuration and structure of an animal of having the limbs as a graphic display. User actuation was answered and the mobile robot 1 of this example can especially do an expression of operation while he has a side face of the pet mold robot designed by imitating the configuration and structure of a dog which are the example of representation of a pet, for example, coexists with human being in human being's living conditions.

[0031] A mobile robot 1 consists of, the idiosoma unit 2, a head unit 3, a tail 4, and Limbs 6A-6D, i.e., leg units.

[0032] The head unit 3 is arranged in the upper bed before abbreviation of the idiosoma unit 2 through the neck joint 7 with a roll, a pitch, and the degree of freedom of each shaft orientations (graphic display) of a yaw. Moreover, the CCD (Charge Coupled Device: charge-coupled device) camera 15 equivalent to the "eye" of a dog, the microphone 16 equivalent to a "lug", the loudspeaker 17 equivalent to "opening", the touch sensor 18 equivalent to tactile feeling, and two or more LED indicators 19 are carried in the head unit 3. The sensor which constitutes a living body's senses besides

these may be included.
[0033] The tail 4 is attached in the abbreviation Gokami edge of the idiosoma unit 2 free [a bow or a splash] through the tail joint 8 with the degree of freedom of a roll and a pitch axis.
[0034] The leg units 6A and 6B constitute a forefoot, and the leg units 6C and 6D constitute hind legs. Each leg units 6A-6D consist of combination of the femoral region units 9A-9D and the leg part units 10A-10D, and are attached in each corner of front and rear, right and left of the base of the idiosoma unit 2, respectively. The femoral region units 9A-9D are connected with each predetermined part of the idiosoma unit 2 by the hip joints 11A-11D with a roll, a pitch, and the degree of freedom of each shaft of a yaw. Moreover, it is connected by the knee joints 12A-12D with the degree of freedom of a roll and a pitch axis between the femoral region units 9A-9D and the leg part units 10A-10D.
[0035] the leg formula mobile robot 1 constituted like a graphic display making the head unit 3 shake vertically and horizontally by driving each joint actuator by the command from a control section mentioned later, or making a tail 4 wag **** -- each -- a foot -- Units 6A-6D -- a synchronization -- it is made to drive cooperatively and actuation of a walk, transit, etc. can be realized.
[0036] In addition, actually, a mobile robot's 1 joint degree of freedom is arranged for every shaft, and is offered by revolution actuation of a joint actuator (not shown). Moreover, the number of the joint degree of freedom which the leg formula mobile robot 1 has is arbitrary, and does not limit the summary of this invention.
[0037] The block diagram of the electrical and electric equipment and control system of a mobile robot 1 is typically shown in drawing 2 . As shown in this drawing, a mobile robot 1 consists of the control section 20 which performs generalization-control of the whole actuation, and other data processing, the I/O section 40, an actuator 50, and a power supply section 60. Hereafter, each part is explained.
[0038] The I/O section 40 contains various kinds of sensors of CCD camera 15 which is equivalent to a mobile robot's 1 eyes as the input section, the microphone 16 equivalent to a lug, the touch sensor 18 equivalent to tactile feeling, or others equivalent to the senses. Moreover, the loudspeaker 17 equivalent to opening or LED indicator 19 which forms the expression of a face by the combination of a flash or the timing of burning is equipped as the output section. These output section can express the user feedback from a mobile robot 1 in the form of [other than a machine motion pattern with a foot etc.].
[0039] A mobile robot 1 can recognize the objective configuration and the color of arbitration which exist on workspace by a camera 15 being included. Moreover, the mobile robot 1 may have further the receiving set which receives dispatch waves other than a vision means like a camera, such as infrared radiation, an acoustic wave, a supersonic wave, and an electric wave. In this case, based on the sensor output which detects each carrier wave, the location and sense from the source of dispatch are measurable.
[0040] An actuator 50 is functional block which realizes machine motion of a mobile robot 1 according to the predetermined motion pattern which a control section 20 orders it, and consists of actuation units prepared for every shafts, such as a roll in each joint, such as the neck joint 7, the tail joint 8, hip joints 11A-11D, and knee joints 12A-12D, a pitch, and a yaw. A mobile robot 1 has the joint degree of freedom of n pieces, therefore

an actuator 50 is constituted from the example of a graphic display by n actuation units. Each actuation unit consists of combination of the driver 53 which controls the revolution location and rotational speed of a motor 51 accommodative based on the output of the motor 51 which performs revolution actuation of the circumference of a predetermined shaft, the encoder 52 which detects the revolution location of a motor 51, and an encoder 52.

[0041] A power supply section 60 is a functional module which supplies electric power to each electrical circuit in literal [the] and a mobile robot 1 etc. The mobile robot 1 concerning this example is the autonomous actuation type which used the dc-battery, and a power supply section 60 consists of a charge dc-battery 61 and a charge-and-discharge control section 62 which manages the charge-and-discharge condition of the charge dc-battery 61.

[0042] The charge dc-battery 61 consists of gestalten of the "battery pack" which package-ized two or more nickel-cadmium battery cels to the cartridge-type.

[0043] Moreover, the charge-and-discharge control section 62 grasps the remaining capacity of a dc-battery 61 by measuring the terminal voltage of a dc-battery 61, charge/strength of discharge current, the ambient temperature of a dc-battery 61, etc., and determines an initiation stage, a termination stage, etc. of charge. The initiation and the termination stage of charge which the charge-and-discharge control section 62 determines are notified to a control section 20, and serve as a trigger for a mobile robot 1 to start and end charge operation.

[0044] A control section 20 is equivalent to "brains", for example, is carried in a mobile robot's 1 head unit 3 or idiosoma unit 2.

[0045] The configuration of a control section 20 is further illustrated in the detail at drawing 3 . As shown in this drawing, the control section 20 has the composition that the bus connection of CPU (Central Processing Unit)21 as a Maine controller was carried out to each circuit component, which are memory and others, or a peripheral device. A bus 27 is a common signal-transmission way containing a data bus, an address bus, a control bus, etc. The address (a memory address or I/O Address) of a proper is assigned at each to each equipment on a bus 27. CPU21 can communicate with the specific equipment on a bus 28 by addressing.

[0046] RAM (Random Access Memory)22 is the memory which consisted of volatile memory, such as DRAM (Dynamic RAM), and which can be written in, loads the program code which CPU21 performs, or is used for temporary preservation of the activity data based on an executive program.

[0047] ROM (Read Only Memory)23 is a read-only memory which stores a program and data everlastingly. The self-test test program performed to a mobile robot's 1 power up, the motion-control program which specifies actuation of a mobile robot 1 are mentioned to the program code stored in ROM23.

[0048] The "sensor input-process program" which processes sensor inputs, such as a camera 15 and a microphone 16, the "action instruction program" which generates a mobile robot's 1 action, i.e., a motion pattern, based on a sensor input and a predetermined model of operation, and the "actuation control program" etc. which controls actuation of each motor, the voice output of a loudspeaker 17, etc. according to the generated motion pattern are contained in a robot's 1 control program. High actuation of entertainment nature, such as a "hand", a "rain check", "stability", and utterance of the

cry of animals, such as "one one", may be included in the motion pattern generated in addition to usual locomotion and transit motion.

[0049] Moreover, creation and various kinds of edited action sequence programs are included, using an authoring tool as a control program of others of a robot 1. An authoring tool is started under a software execution environment predetermined in the computer system top installed for example, in the robot 1 exterior. However, it explains in detail to the program created and edited by the authoring tool list on this tool, therefore the back.

[0050] Like EEPROM (Electrically Erasable and Programmable ROM), nonvolatile memory 24 consists of memory devices in which elimination re-writing is possible electrically, and it is used in order to hold the data which should be updated serially in un-volatilizing. Security information, such as a serial number and a cryptographic key, the various models which specify a mobile robot's 1 behavior pattern are mentioned to the data which should be updated serially.

[0051] An interface 25 is equipment for interconnecting with the device besides a control section 20, and making the data exchange possible. An interface 25 performs data I/O between a camera 15, a microphone 16, and a loudspeaker 17. Moreover, an interface 25 is each driver 53-1 in an actuator 50. -- I/O of data or a command is performed in between.

[0052] An interface 25 Moreover, serial interface, such as RS(Recommended Standard)-232C, Parallel interfaces, such as IEEE (Institute of Electrical and electronics Engineers)1284, A USB (Universal Serial Bus) interface, An i-Link (IEEE1394) interface, a SCSI (Small Computer System Interface) interface, It has a general interface for peripheral-device connection of computers, such as a memory card interface, and may be made to perform program and migration of data between the external instruments by which local connection was made.

[0053] Moreover, as other examples of an interface 25, it has an infrared-ray-communication (IrDA) interface, and may be made to radiocommunicate with an external instrument.

[0054] Furthermore, a control section 20 can perform an external host computer 100 and data communication via contiguity radiocommunication as shown in "bluetooth" or ".11B" or LAN (Local Area Network:, for example, Ethernet), or the Internet including the radiocommunication interface 26, Network Interface Card (NIC) 27, etc.

[0055] One object of the data communication between such a mobile robot 1 and a host computer 100 is calculating a mobile robot's 1 complicated motion control, or operating by remote control using the computer resource of the robot 1 exterior (namely, remoteness).

[0056] Moreover, other objects of this data communication are to supply data and program of the robots 1, such as a model of operation and other program codes, required for motion control to a mobile robot 1 from the equipment of a network course and remoteness.

[0057] Moreover, other objects of this data communication are debugging processings of the real time according using an authoring tool (after-mentioned) to collaboration-actuation with creation, the edited download of the program for robot motion control, the host computer 100 of such a program for motion control, and a robot 1 on a host computer 100.

[0058] A control section 20 may be equipped with the keyboard 29 which consists of a ten key and/or an alphabet key. A keyboard 29 is used in a robot's 1 work site for command input with a direct user, and also it is used for the input of owner authentication information, such as a password.
[0059] The mobile robot 1 concerning this example can perform autonomous (that is, a help does not intervene) actuation, when a control section 20 performs a predetermined motion-control program. Moreover, while having an input unit equivalent to the senses of human beings, such as an image input (namely, camera 15), voice input (namely, microphone 16), and a touch sensor 18, or an animal, it has the intelligence which performs reasonable or emotional action which answered these external inputs.
[0060] The mobile robot 1 constituted as shown in drawing 1 - drawing 3 has the following descriptions. Namely, [0061] (1) When changing from a certain position to other positions is directed, between each position cannot be changed directly but it can change via an in-between position without the unreasonableness prepared beforehand.
(2) Advice can be received when the position of arbitration is reached by position transition.
(3) Attitude control can be carried out, managing a position independently in each unit unit, such as a head, a foot, and the tail section. Namely, apart from the whole robot's 1 position, a position is manageable for every unit.
(4) A parameter to show the detail of actuation of an instruction of operation can be passed.
[0062] As shown in drawing 3 , the mobile robot 1 concerning this example interconnects with the external host computer 100 via the network. Or the means of communications of radiocommunication (for example, bluetooth and .11B short distance wireless data transmission) or others may connect in the host computer 100.
[0063] On a host computer 100, a predetermined software execution environment is built, under this environment, an authoring tool can be started, and a robot's 1 operating sequence can be created and edited comparatively easily and efficiently by interactive processing. However, about the detail of an authoring tool, it mentions later.
[0064] In drawing 4 , the example of a hardware configuration of a host computer 100 is illustrated typically. Hereafter, each part in a computer 100 is explained.
[0065] CPU (Central Processing Unit)101 which is the Maine controller of a system 100 performs various kinds of applications under control of an operating system (OS). Although OS offers the GUI (Graphical User Interface) environment more preferably, it is good at Windows 98 [UNIX (trademark) or] of U.S. Microsoft/NT, for example.
[0066] CPU101 interconnects with other equipments (after-mentioned) by bus 107 as the graphic display. The memory address or I/O Address of a proper is given to each device on a bus 107, respectively, and access to a specific device is possible for CPU101 by these addresses. Although buses 107 are a data bus, an address bus, and a common signal-transmission way containing a control bus, the example is a PCI (Peripheral Component Interconnect) bus.
[0067] Memory 102 is storage used since the program code performed in a processor 101 is stored or the activity data under activation are stored temporarily. Please understand the memory 102 shown in this drawing to be a thing containing both un-volatilizing and volatilization memory.
[0068] The display controller 103 is an exclusive controller for processing actually the

drawing instruction which CPU101 publishes, for example, supports a bit map drawing function equivalent to SVGA (Super Video Graphic Array) or XGA (eXtended Graphic Array). Once it is written in a frame buffer (not shown), the screen output of the drawing data processed in the display controller 103 is carried out at a display 111. Indicating equipments 111 are for example, a CRT (Cathode Ray Tube) display, a liquid crystal display display (Liquid Crystal Display), etc.

[0069] The input device interface 104 is equipment for connecting user input devices, such as a keyboard 112 and a mouse 113, to a system 100. The input device interface 104 answers the coordinate directions input through the key input or mouse 113 by the keyboard 112, and generates interruption to CPU101.

[0070] According to predetermined communications protocols, such as Ethernet, it can connect with networks, such as LAN (Local Area Network), or the network interface 105 can connect a system 100 to short-distance wireless data transmission like bluetooth or .11B. Generally, the network interface 105 is offered with the gestalt of a LAN adapter card, and the PCI bus slot on a mother board (not shown) equips with it, and it is used.

[0071] In the example shown in drawing 3 , although the host computer 100 interconnects with the robot 1 via wireless data transmission or a network, of course, both may be connected by other means of communications and data migration means. For example, it may be made to perform exchange and migration of data through an archive medium like memory card (memory stick).

[0072] Moreover, on the network, two or more host computers (not shown) are connected in the transparent condition, and the distributed computing environment is built. Distribution of a software program, data contents, etc. is performed on a network. For example, the authoring tool concerning this example, the action sequence program for robots (the action file which serves as base of an action sequence further, a motion file, a sound file, LED actuation file) created and edited by this authoring tool can be distributed via a network. Moreover, network distribution service of such a program/data may be offered the charge or for nothing.

[0073] The external instrument interface 106 is equipment for connecting external devices, such as a hard disk drive (HDD) 114 and the media drive 115, to a system 100. The external instrument interface 106 is based on interface specification, such as IDE (Integrated Drive Electronics) and SCSI (Small Computer System Interface).

[0074] HDD114 is the external storage which carried the magnetic disk as storage support fixed (common knowledge), and excels other external storage in points, such as memory capacity and a data transfer rate. It calls it "install" to the system of a program to place on HDD116 in the condition that a software program can be performed. Usually, the program code of the operating system which a processor 511 should perform, an application program, a device driver, etc. are stored in HDD114 in un-volatilizing. For example, creation and the edited action sequence programs for robots (the action file which serves as base of an action sequence further, a motion file, a sound file, LED actuation file, etc.) are installable on HDD114 using the authoring tool concerning this example, and this authoring tool.

[0075] Moreover, the media drive 115 is equipment for loading with portable mold media, such as CD (Compact Disc), and MO (Magneto-Optical disc), DVD (Digital Versatile Disc), and accessing a data-logging side.

[0076] Portable mold media are used in order to mainly move backing up a software

program, a data file, etc. as data of a computer-readable format, and these between systems (that is, a sale, a negotiation, and distribution are included). For example, these portable mold media can be used, and the authoring tool concerning this example, the action sequence program for robots (the action file which serves as an action sequence further, a motion file, a sound file, LED actuation file) created using this authoring tool can be physically circulated and distributed between devices.

[0077] In addition, an example of the host computer 100 as shown in drawing 4 is the compatible machine or succeeding machine of personal computer"PC/AT(Personal Computer/Advanced Technology)" of U.S. IBM. Of course, it is also possible to apply the computing system equipped with other architecture as a host computer 100 concerning this operation gestalt.

[0078] B. In configuration this example of an authoring system, creation and edit of the motion-control program which consists of a series of command/data which describe a robot's 1 predetermined pattern of operation can be done using the authoring tool started on the host computer 100. Moreover, creation and the edited motion-control program are transmitted to a robot 1 side using radiocommunication means, such as bluetooth and .11B, using this authoring tool, and collaboration-actuation with a host computer 100 and a robot 1 performs debugging processing. That is, the authoring system for supporting creation and edit of a mobile robot's 1 motion-control program is built by organic association between a host computer 100 and a robot 1.

[0079] In drawing 5 , the whole authoring system configuration is illustrated typically.

[0080] In a host computer 100 side, a user can use the GUI (Graphical User Interface) screen which an authoring tool offers, and can create and edit the action sequence of a convention of a mobile robot 1 by mouse actuation (however, about the detail of the editing operation on this GUI screen, the after-mentioned is yielded at the GUI screen list for action sequence creation). Or a user can use the usual text editor etc., and can create and edit a robot's 1 motion-control program in a script format (for example, high level language formats, such as C).

[0081] An authoring tool changes the motion-control program of the action sequence which the user created and edited on the GUI screen, and the script format created and edited on the text editor into the mnemonic code of a format similar to the assembler called "RCODE".

[0082] RCODE said here is the programming language upon which it was decided as controlling a robot 1 using an easy command. Since it also has fundamental control structures, such as "IF" and "GO", RCODE can be used also as a minimum level script language for robot controls.

[0083] The RCODE motion-control program created and edited on the host computer 100 is movable to a robot 1 side using media, such as a memory stick. Moreover, at the time of debugging of a RCODE motion-control program, a RCODE program is taken out for every line, and it enciphers, and transmits to a robot 1 side serially using radiocommunication means, such as bluetooth and .11B.

[0084] On the other hand, in the robot 1 side, it has an interpreter/debugger, middleware, the driver, and the operating system (OS) as the motion-control program execution described by RCODE etc., and a debugging environment.

[0085] An interpreter is a high-level-language program which reads at a time the program of one line described in the RCODE format, interprets it, and performs it. However, in

the time of debugging etc., when a RCODE program is transmitted in the format enciphered from the host computer 100 side, once an interpreter decrypts this, it needs to perform interpretation and activation.
[0086] A debugger discovers the error in a RCODE program (bug), and is a program which supports the activity which corrects. That is, according to the debugger, activation can be stopped in the line which specified the program, or the memory at that time and the content of the variable can be referred to.
[0087] Middleware is a meeting of a software module which offers a robot's 1 fundamental function, and the configuration of each module is influenced of hardware attributes, such as a robot's 1 mechanical and electric property and specification, and a configuration. Middleware is functionally divided roughly into the middleware of a recognition system, and the middleware of an output system.
[0088] The middleware of a recognition system is an engine which receives raw data from hardware, such as image data, voice data, and detection data obtained from other sensors, via a virtual robot, and processes these. That is, based on various input, speech recognition, distance detection, position detection, contact, motion detection, color recognition, etc. are processed, and a recognition result is obtained. A recognition result is notified to the application layer (action sequence program) of a high order.
[0089] On the other hand, in the middleware of an output system, functions, such as a walk, playback of a motion, composition of an output sound, and flash control of a LED indicator, are offered. That is, the action plan drawn up in the application layer is received, the servo command value of each fastener of a robot, an output sound, output light (LED), output voice, etc. are generated for every function of a robot 1, and it demonstrates on a robot 1.
[0090] A driver is a program code for operating hardware of each joint actuator or others.
[0091] In this example, the driver is mounted in the middleware list by the object-oriented program. The software based on object-oriented is fundamentally treated in the module unit of the "object" which made the processing procedure over data and its data unify. Moreover, if needed, two or more objects are created or one software is completed by combining. Generally, according to the object oriented programming, it is thought that the efficiency of development and maintenance of software is increased.
[0092] An operating system (OS) performs control about management of the data communication between these objects, and other program executions. OS is also mounted by the object-oriented program.
[0093] C. The scenario of operation created using the authoring tool concerning creation / edit this example of the program for robots of operation using an authoring tool is realized in creation and edit of "behavior", and creation and edit of "action." The information which is needed in order to make behavior and action is summarized to the file called a "project", and is managed.
[0094] Action is constituted by unifying each contents called the motion file and sound file by which the synchronization was taken on the time-axis, and an LED actuation file. One action file is a command (it is also called "semantics") reproduced in general in about 10 seconds.
[0095] A motion file is a file which specifies actuation of each joint actuator of a mobile robot 1. By this example, by arranging serially two or more key frames which described signs that the mobile robot 1 was made to take a desired pause on the GUI edit display

can prescribe a motion (after-mentioned).
[0096] A sound file is sound data for carrying out a voice output through a loudspeaker 17, for example, is constituted as a file of MIDI (Musical Instrumental Digital Interface) or a WAVE format. For example, the sound file described in the MIDI format is not as information on the sound itself, performance information, such as magnitude, die length, a tone, and effectiveness, can be changed into numeric data, and music can be expressed. In this example, performance information can be edited by operating each numeric data of the MIDI format which constitutes sound through a GUI edit display (after-mentioned).
[0097] An LED actuation file is data for specifying the combination of burning actuation of two or more LED indicators 19, and the timing of a flash, and is used for the purpose of forming the expression of a face. In this example, an LED actuation file is described in a MIDI format, and can edit an LED actuation file free through a GUI edit display (after-mentioned).
[0098] In this example, the work environment for the action edit which can take the synchronization between each contents, such as a motion, a sound, and LED actuation, to preparation is offered by using the time line on the action edit display of a GUI format so that it may mention later. Moreover, each contents can be processed as each data, and also it can be dealt with as the format, i.e., a format of action, unified with other contents.
[0099] "Behavior" is a file which is constituted by putting two or more commands, i.e., action, in order and which specifies behavior of a mobile robot 1 (refer to drawing 6). Action is reproduced from a start to an end in an one direction. On the other hand, behavior can specify the sequence which reproduces action. Furthermore, it can box-ize, branching (refer to drawing 7) based on conditions or a probability, and two or more commands, i.e., action, and a subroutine can be defined (refer to drawing 8). Therefore, behavior can be compared with action and can describe a mobile robot's 1 complicated action sequence with altitude more.
[0100] A project holds the reference list of a mobile robot's 1 configuration (CPC:Configured Peripheral Component), the behavior file made on an authoring system, and action files. Moreover, a project also holds the reference list of a raw material (contents) and files required in order to make an action file (namely, a motion, a sound, LED actuation). Hardware Configuration Information which serves as a configuration said here from the combination of the physical component of the robots 1, such as a fuselage, a head, and the leg, is set up.
[0101] At the time of project edit, a "project window" as shown in drawing 34 is displayed. In a project window, the list of each files, such as a behavior file used for edit of action, an action file, a motion file, a sound file, and an LED actuation file, is displayed on the edit list of behavior in a tree format as a graphic display.
[0102] Functionally, the authoring system concerning this example consists of an "action edit subsystem" into which it edits, the command, i.e., action, which consists of each contents, such as a motion, a sound, and LED actuation, and a "behavior edit subsystem" into which a robot's behavior is edited by putting two or more commands, i.e., action, in order.
[0103] C-1. An action edit subsystem action edit subsystem is a subsystem for creating and editing each action used, a robot's action sequence, i.e., behavior.
[0104] Action has the time die length for performing action, and specifies an initial pause

and the last pause. Action is constituted by setting out in LED actuation etc. with a motion (motion) of the robot within the execution time, and a sound. The thing of the file which specifies action is called an "action file." Reading from the outside of a file is sufficient as contents, such as a motion which action uses, a sound, and LED actuation.
[0105] The action edit in this example adopts the graphical user interface, i.e., an "action editor", centering on the edit which followed on the time-axis so that it may mention later. In action edit, 3D edit of the pause which specifies a motion, a sound, LED actuation, etc. edit each contents. These contents are time series data, and since the channel which displays each contents is arranged along with a time-axis and he is trying to display it on the time table of a two-dimensional time-line format, creation and edit of an action edit subsystem can be done, checking the synchronization between each time series data visually.
[0106] The functional configuration of an action edit subsystem is typically shown in drawing 9 . As shown in this drawing, especially the action edit subsystem concerning this example is designed for [of action] edits, and consists of the action editorial department, the key frame editorial department, the motion editorial department, the sound editorial department, the LED actuation editorial department, and a user interface control section that realizes the editing task of the user by each [these] functional module by the dialogic operation by the GUI screen.
[0107] The action editorial department is a functional module for editing a motion file, a sound file, and an LED actuation file in the format that a synchronization is taken on a time-axis. The action editorial department shows a user the action edit window for setting up the timing of the joint actuation (motion) in alignment with a mobile robot's 1 time-axis, and a sound and LED actuation through a user interface control section. The action edit window is equipped with the edit field which consists of a table of the time-line format for setting up various kinds of files on a time-axis.
[0108] The key frame editorial department is a functional module for editing a key frame, i.e., the image frame which described the pause in the time of day when the mobile robot which performs a motion corresponds. The key frame editorial department is answered and called to the user actuation to the action editorial department, and the editing task by the user is received through the key frame channel opened on an action edit window. By the key frame channel, the thumbnail showing a key frame is put on each location where it corresponds on a time-axis.
[0109] The motion editorial department is a functional module for editing serial actuation of each joint actuator which constitutes a motion, i.e., a mobile robot. The motion editorial department is answered and called to the user actuation to the action editorial department, and the editing task by the user is received through the motion channel opened on an action edit window. By the motion channel, each timing chart which describes serial actuation of each joint actuator is listed in the shape of a tree according to biomodel (tree view).
[0110] The sound editorial department is a functional module for setting up the detail of the sound which is one of the components of action. In this example, a sound is treated in a MIDI format or a WAVE format. The sound editorial department shows a user the sound detail window for setting up the detail of a sound along a time-axis top through a user interface control section. The sound detail window is equipped with the edit field which consists of a table of the two-dimensional time-line format which consists of a

lateral time-axis and a channel of a lengthwise direction (after-mentioned).
[0111] The LED actuation editorial department is a functional module for setting up the detail of the LED actuation which is one of the components of action. In this example, LED actuation is treated in a MIDI format. The LED actuation editorial department shows a user the LED detail window for setting up the detail of LED actuation along a time-axis top through a user interface control section. The LED detail window is equipped with the edit field which consists of a table of the two-dimensional time-line format which consists of a lateral time-axis and a channel of a lengthwise direction (after-mentioned).
[0112] A user interface control section shows a user a project window (above-mentioned) at the time of project edit.
[0113] Moreover, a user interface control section answers the user directions through each edit window, and can access now each file system (or database) which manages a behavior file, an action file, a motion file, a sound file, and an LED actuation file.
[0114] The configuration of an action edit window is roughly shown in drawing 10 . On this action edit window, the timing of the joint actuation (motion) in alignment with a mobile robot's 1 time-axis, and a sound and LED actuation can be set up. The edit result in this edit window is saved as an action file with extension "act".
[0115] The edit field of an action edit window is the table of the two-dimensional time-line format which consists of a lateral time-axis and a channel of a lengthwise direction as a graphic display. In a time-line table, it consists of a time amount ruler, a key frame channel, a motion channel, a sound channel, and an LED actuation channel.
[0116] A time amount ruler can change the frame number display with a real-time display using a unit change radio carbon button (the real-time display is chosen in the example shown in drawing 10). The unit of the graduation of a real-time display is considered as a second:ms (double figures each) display.
[0117] The time amount ruler includes the end time field and the current time stamp field other than a unit change radio carbon button.
[0118] The time-of-day numeric value which shows the end time (namely, operating time) of action under edit is displayed on the end time field (in the example of a graphic display, "09:40" (=9 second 40) is displayed). Moreover, the time-of-day numeric value of a current location is displayed on the current time stamp field (in the example of a graphic display, "04:60" (=4 second 60) is displayed). If the time-of-day figure which is the text field which can be edited and is meaningful is inputted, it becomes end time, the last key frame will move or current time of day will move these fields to the location.
[0119] In an edit field, a "key frame line", and the "last time stamp line" and a "current time-of-day line" are displayed as a time stamp line, respectively.
[0120] The key frame line which shows the time of day of each key frame is made to be displayed in the form which crosses each channel top. Therefore, a user can perform an editing task, checking the synchronization between each contents called a motion, a sound, and LED actuation visually.
[0121] Moreover, since he is trying for the end time line which shows the end time of action under edit to display each channel top in the crossing form, a user can understand visually the range of the time amount used as the object for edit. An end time line can also be caught with the last pause key frame line.
[0122] Moreover, he is trying for the current time-of-day line which shows current time

to display each channel top in the crossing form. Fundamentally, a click of on one of channels moves current time of day to the location.
[0123] A key frame channel is a field for displaying a key frame according to the time-axis which a time amount ruler specifies.
[0124] In the example shown in drawing 10 , switching operation is possible for a key frame channel. The action edit window in the condition (key frame detail channel) of having opened the key frame channel is shown in drawing 11 . By the key frame channel, the thumbnail showing a key frame is put on each location where it corresponds on a time-axis. The "key frame" said here is an image frame which described the pause in the time of day when the mobile robot which performs a motion corresponds.
[0125] An initial pause and the last pause are special key frames located in the start of a key frame channel, and an end, respectively. The key frame of the beginning and the last is placed beforehand.
[0126] On a key frame channel, the frame (henceforth a "interpolation frame") interpolated by the key frame of the ends which sandwich this time amount will be reproduced by the time amount by which the key frame is not arranged. A interpolation frame is not displayed on a key frame. In the authoring system concerning this example, when each key frame is arranged on a key frame channel, a motion which connects smoothly the pause described by each key frame is generated automatically by computer processing. Moreover, the center of gravity of 3D model can be set up by each key frame, and the motion on the appearance of 3D model can be made into the thing near the system.
[0127] Each key frame is arranged on a key frame channel so that the left end of a thumbnail may serve as time of day of a key frame. Moreover, by dragging a thumbnail to right and left along with a time-axis, it follows, and a key frame line can move and can change the time of day of the corresponding key frame. Moreover, telescopic motion of the key frame of the last pause turns into telescopic motion of the whole action time amount.
[0128] If a thumbnail is double-clicked, the pause edit window of the corresponding pause can open and a pause can be edited. However, an initial pause and the last pause are the outsides for edit, and even if it double-clicks these, there is no pause edit window in open.
[0129] A motion channel is a field for meeting the time-axis which a time amount ruler specifies, and editing and displaying the content of the motion.
[0130] In this example, switching operation is possible for a motion channel. The action edit window in the condition (motion detail channel) of having opened the motion channel is shown in drawing 12 . A motion is defined by actuation of each joint actuator which constitutes a mobile robot 1. By the motion channel, each timing chart which describes serial actuation of each joint actuator is listed in the shape of a tree according to biomodel (tree view).
[0131] The line graph on each timing chart shows the motion of the corresponding joint actuator, i.e., the temporal response of angle of rotation. By dragging the crossing point of a key frame line and the polygonal line up and down, the set point in the time amount concerned of the corresponding joint actuator can be changed. Moreover, as a result of such drag actuation, the pause applicable to a key frame line also changes, and renewal of automatic also of the content of the key frame is carried out.

[0132] A sound channel is a field for displaying sound data along with the time-axis which a time amount ruler specifies. In this example, from an action edit window, independent "sound detail window" can be opened and the sound data of a MIDI format can be edited by GUI actuation on this window.
[0133] An LED actuation channel is a field for displaying LED actuation data along with the time-axis which a time amount ruler specifies. In this example, from an action edit window, independent "LED detail window" can be opened and the LED actuation data of a MIDI format can be edited by GUI actuation on this window.
[0134] The configuration of the sound detail window for editing the sound file of a MIDI format is roughly shown in drawing 13 . The edit field of this sound detail window is the table of the two-dimensional time-line format which consists of a lateral time-axis and a channel of a lengthwise direction as a graphic display. The inside of a time-line table consists of a time amount ruler, a key frame channel, a score channel, and a velocity channel.
[0135] A time amount ruler can change the frame number display with a real-time display using a unit change radio carbon button (the real-time display is chosen in the example shown in drawing 13). The end time field and the current time stamp field other than a unit change radio carbon button are included in the time amount ruler. The time-of-day numeric value which shows the end time of action under edit is displayed on the end time field, and the time-of-day numeric value of a current location is displayed on the current time stamp field. If the time-of-day figure these fields have a meaning is inputted, it becomes end time, the last key frame will move or current time of day will move to the location.
[0136] In an edit field, a "key frame line", and the "last time stamp line" and a "current time-of-day line" are displayed as a time stamp line, respectively. The key frame line which shows the time of day of each key frame (after-mentioned) is displayed in the form which crosses each channel top, and a user can perform the editing task of a MIDI sound, checking the synchronization with a key frame visually. Moreover, since he is trying for the end time line which shows the end time of action under edit to display each channel top in the crossing form, a user can understand visually the range of the time amount used as the object for edit. Moreover, he is trying for the current time-of-day line which shows current time to display each channel top in the crossing form. Fundamentally, a click of on one of channels moves current time of day to the location.
[0137] The key frame location acquired from the action edit window along with the time-axis which a time amount ruler specifies is expressed as a key frame channel.
[0138] A score channel is a field for editing a MIDI sound by GUI actuation, and is constituted by a piano keyboard (however, the effective compass is different with a mobile robot's 1 model), and the basic grid of the direction of a time-axis.
[0139] With a piano keyboard, the maximum compass permitted by a mobile robot's 1 hardware specification etc. by the image display of a piano keyboard is displayed (or refreshable compass is displayed brightly and it may be made to indicate except [its] by gray). [0140] which displays the absolute pitch of sound, such as C3 and C4, on basic C key part The grid of the time amount width of face of the set-up quarter note is displayed on a score part. Moreover, the line of two grids (namely, two rhythm), three grids (three rhythm), and four grids (four rhythm) is emphasized with the value (above-mentioned) set up by rhythm.

[0141] On a score channel, a score is constituted by the height of a piano key with the sound length which becomes the criteria of a time-axis. One grid is called a "cel." A color is attached to a cel with a sound. However, in the case of the playback model of only one sound, a sound cannot be put on the scale from which it differs on the same time-axis. Moreover, a click of an empty cel (that is, the color is not attached) places the sound of the die length of the note mark chosen. When a sound exists in other height on the same time amount, a sound replaces the clicked height. A click of the cel in which a sound already exists removes the sound.
[0142] Note marks, such as 16 diacritical marks, 8 diacritical marks, a quarter note, a half note, a whole note, dotted 8 diacritical marks, a dotted quarter note, and a dotted half note, are displayed on the field on the left-hand side of a piano keyboard. These note mark shall have an exclusive selection condition mutually, and only any one shall always be chosen. Moreover, a selection item changes with mouse click actuation.
[0143] A velocity channel is a field which displays the strength of the velocity for every sound. In the example shown in drawing 13 , although sound intensity is displayed with a bar graph, it may be displayed by the line graph. The sound intensity in each joint can be depended and adjusted to dragging the maximum upper bed of a bar graph. The maximum sound volume is set up by the default.
[0144] Moreover, the configuration of the sound detail window for displaying the sound file of a WAVE format is roughly shown in drawing 14 . A sound detail window is the table of the two-dimensional time-line format that a title bar, a menu bar, and the edit field of a WAVE formal sound file consist of a lateral time-axis and a channel of a lengthwise direction, as a graphic display. The inside of a time-line table consists of a time amount ruler, a key frame channel, and a WAVE channel.
[0145] A time amount ruler can change the frame number display with a real-time display using a unit change radio carbon button.
[0146] The time-of-day numeric value which shows the end time (namely, operating time) of action under edit is displayed on the end time field. Moreover, the time-of-day numeric value of a current location is displayed on the current time stamp field. If the time-of-day figure these fields have a meaning is inputted, it becomes end time, the last key frame will move or current time of day will move to the location.
[0147] In an edit field, a "key frame line", and the "last time stamp line" and a "current time-of-day line" are displayed as a time stamp line, respectively. The key frame line which shows the time of day of each key frame is displayed in the form which crosses each channel top, and a user can perform the editing task of a WAVE sound, checking the synchronization with a key frame visually. Moreover, since he is trying for the end time line which shows the end time of action under edit to display each channel top in the crossing form, a user can understand visually the range of the time amount used as the object for edit. Moreover, he is trying for the current time-of-day line which shows current time to display each channel top in the crossing form. Fundamentally, a click of on one of channels moves current time of day to the location.
[0148] The key frame location acquired from the action edit window along with the time-axis which a time amount ruler specifies is expressed as a key frame channel.
[0149] As shown in drawing 14 , the contents of the sound file of a WAVE format are expressed as a WAVE channel as a wave.
[0150] Moreover, the configuration of the LED detail window for displaying and editing

into drawing 15 the LED actuation file described in the MIDI format is shown roughly. The edit field of a sound detail window is the table of the two-dimensional time-line format which consists of a lateral time-axis and a channel of a lengthwise direction as a graphic display. The inside of a time-line table consists of a time amount ruler, a key frame channel, and a score channel.

[0151] A time amount ruler can change the frame number display with a real-time display using a unit change radio carbon button. The time amount ruler includes the end time field and the current time stamp field other than a unit change radio carbon button. The time-of-day numeric value which shows the end time of action under edit is displayed on the end time field. Moreover, the time-of-day numeric value of a current location is displayed on the current time stamp field. If the time-of-day figure these fields have a meaning is inputted, it becomes end time, the last key frame will move or current time of day will move to the location.

[0152] In an edit field, a "key frame line", and the "last time stamp line" and a "current time-of-day line" are displayed as a time stamp line, respectively. The key frame line which shows the time of day of each key frame is displayed in the form which crosses each channel top, and a user can perform the editing task of the LED actuation described in the MIDI format, checking the synchronization with a key frame visually. Moreover, since he is trying for the end time line which shows the end time of action under edit to display each channel top in the crossing form, a user can understand visually the range of the time amount used as the object for edit. Moreover, he is trying for the current time-of-day line which shows current time to display each channel top in the crossing form. Fundamentally, a click of on one of channels moves current time of day to the location.

[0153] The key frame location acquired from the action edit window along with the time-axis which a time amount ruler specifies is expressed as a key frame channel.

[0154] A score channel is a field for editing the LED actuation described by GUI actuation in a MIDI format, and is constituted by the list of parts which have arranged LED on mobile-robot 1 body, and the basic grid of the direction of a time-axis. In this example, LED is arranged at least at each part of **** (******), a right eye alpha and a left eye alpha, a right eye beta, a left eye beta, a right eye gamma, a left eye gamma, a tail alpha, and a tail beta.

[0155] On a score channel, the score for every list is constituted at least for each part by displaying the burning situation of LED like each part on a time-axis. One grid is called a "cel." The color and the color according to burning reinforcement are attached to the cel of the location equivalent to the part which LED turns on on a time-axis.

[0156] It is shown in the left of a score channel the LED part visual ** table. This carries out the graphic expression only of each part of LED which can be changed.

[0157] Moreover, the velocity mark is displayed on as visual a lower part as the LED section. A velocity mark is a mark which displayed classes, such as lifting, a high end keeping, and descent. These marks have an exclusive selection condition mutually, and one is always chosen by something. Moreover, a selection item changes with mouse clicks.

[0158] The action edit subsystem concerning this example is preparing the preview window, in order to check visually the content of action edited on the above-mentioned action edit window (refer to drawing 10).

[0159] The configuration of a preview window is roughly shown in drawing 16 . As

shown in this drawing, a preview window consists of a "3D view", and the "current time-of-day field" and a "playback carbon button group". [a "3D display change carbon button group", and]

[0160] The three-dimension mobile robot's 1 image generated by computer graphics processing is always displayed on 3D view. By dragging on this view, the direction of a look can be moved and how a view appears can be changed. Moreover, although not illustrated, you may constitute so that 3D model can be simultaneously previewed from two or more views. Moreover, a motion of a view is interlocked with the user input actuation on a 3D display change carbon button group.

[0161] In case creation processing of the 3D display of a motion is carried out, at least each part may be equipped with the collision (collision) of comrades, or the check function of the actuation rate of each joint with 3D model. Moreover, the center of gravity of 3D model can be set up by each key frame, and the motion on the appearance of 3D model can be made into the thing near the system.

[0162] Moreover, the LED actuation preview field for displaying LED actuation is arranged in the right-hand side of 3D view. In this preview field, it is made to synchronize with a motion of the mobile robot 1 on 3D view mentioned above, and signs that a mobile robot's 1 LED blinks are displayed.

[0163] Each carbon button "a revolution", "zoom-in/out", a "pan", and a "home location" is arranged in the 3D display change carbon button group. A user can change the direction of a look to the robot in 3D view by carrying out click actuation of these carbon buttons.

[0164] For example, if a revolution carbon button is clicked, it will become revolution mode, and if 3D view is dragged henceforth, the mobile robot 1 in 3D view will rotate. Moreover, if zoom-in / out carbon button is clicked, it will become zoom mode, and if 3D view is dragged up and down henceforth, the mobile robot 1 in 3D view will do zoom-in/out. moreover -- if 3D view will become panmode if a pancarbon button is clicked, and 3D view is dragged vertically and horizontally henceforth -- 3D view -- a pan -- that is, high-speed migration is carried out. Moreover, if a home location carbon button is clicked, a mobile robot's 1 three-dimensional display will return to the condition of having seen from the default view of a look, i.e., default direction.

[0165] The current time of day of the content of drawing currently displayed on 3D view is displayed on the current time-of-day field. If the alphabetic character this field has a meaning as time of day is inputted, the display of 3D view will change to the frame of the corresponding time of day. Moreover, the time-of-day location of KARENTO is relatively indicated by visual.

[0166] Each carbon button "rewinding [of a frame]", "a front key frame", "a play/stop", "coma delivery of a frame", "frame delivery", and "loop-formation playback" is arranged in the playback carbon button group.

[0167] If it clicks "rewinding [of a frame]", the display of 3D view will return to the first frame. If "a front key frame" is clicked, the display of 3D view will fly to the last key frame from a current location. Moreover, a click of "a play/stop" starts or suspends playback of 3D view display (during a play, a play/stop button is stopped and acts as a play during a stop). Moreover, if "coma delivery of a frame" is effective only during playback of 3D view display and it is clicked, coma delivery of one frame will be carried out. Moreover, a click of "frame delivery" advances the display of 3D view to the last

frame. Moreover, a click of "loop-formation playback" carries out loop-formation playback of the display of 3D view.
[0168] Moreover, the action edit subsystem concerning this example is preparing the pause window, in order to edit a mobile robot's 1 three-dimension-pause by GUI actuation which makes a drag the keynote. The pause edited on a pause window can be used as a key frame which constitutes a motion.
[0169] The configuration of a pause window is roughly shown in drawing 17 . On this pause window, angle of rotation of each joint actuator which constitutes a mobile robot 1 is directly directed by GUI actuation, and a desired pause can be specified simply. A pause window consists of a stereo viewing area, the list appointed field, a set point field, a 3D viewing area, a 3D display change carbon button group, and display change pop up.
[0170] A mobile robot's 1 expansion top view is displayed, and a user is made to choose the part which can be edited in the stereo appointed field. The item of list assignment is chosen, by the 3D display up, it blinks and, as for the selected part, highlighting or the content which is set point area changes.
[0171] In the list appointed field, a mobile robot's 1 part which can be edited and the set point are displayed as a list. if a user chooses a specific part out of this list, in the stereo appointed field, the corresponding part will carry out highlighting -- having -- 3D viewing area -- highlighting -- or it blinks and the content of the set point field changes.
[0172] In the set point field, a list indication of the maximum is given at the setting-out part name of each part which can be edited, the set point, and the minimum value list that can be set up. If a specific part with a user is chosen, the content will change. The set point can be keyed directly in the field which can be inputted. The expression of an include angle can be considered as a radii expression, and the set point can be changed by dragging the line for assignment.
[0173] In 3D viewing area, a mobile robot's 1 whole body image generated by 3D graphics is drawn with a ground surface. A user can choose that part by clicking the part which corresponds from this 3D display, and highlighting of the selection part is carried out. Furthermore, the set point can be directly changed by dragging a selection part.
[0174] The content of a display in 3D viewing area is being interlocked with the 3D display change carbon button, and can change by dragging the view top of this 3D viewing area, the way of a look, i.e., direction, a view appears.
[0175] Each carbon button "a revolution", "zoom-in/out", a "pan", and a "home location" is arranged in the 3D display change carbon button group. A user can change the direction of a look in 3D viewing area by carrying out click actuation of these carbon buttons.
[0176] For example, if a revolution carbon button is clicked, it will become revolution mode, and if 3D viewing area is dragged henceforth, the mobile robot 1 in 3D viewing area will rotate. Moreover, if zoom-in / out carbon button is clicked, it will become zoom mode, and if 3D viewing area is dragged up and down henceforth, a mobile robot 1 will do zoom-in/out within 3D viewing area. moreover -- if it will become panmode if a pancarbon button is clicked, and 3D viewing area is dragged vertically and horizontally henceforth -- the inside of 3D viewing area -- a mobile robot 1 -- a pan -- that is, high-speed migration is carried out. Moreover, if a home location carbon button is clicked, a mobile robot's 1 three-dimensional display will return to the condition of having seen from [default] the look.

[0177] The "O.K." carbon button and "cancellation" carbon button are prepared for the pause window. If the O.K. carbon button is clicked, all the edit items in this window will be confirmed, and this window will be closed. On the other hand, if a Cancel button is clicked, all edit items will be made into an invalid and this window will be closed (common knowledge).
[0178] Moreover, the action edit subsystem concerning this example is preparing the motion pre viewer for previewing the motion edited by the motion channel, or the motion which used as the key frame each pause edited by the POVU window. The configuration of a motion pre viewer is roughly shown in drawing 18 .
[0179] On a motion pre viewer, while previewing a motion, in order to paste on an action edit window, copying a pause is permitted.
[0180] On a motion pre viewer, the thumbnail of one or more key frames, i.e., a pause, which constitute a motion is displayed. The array of a key frame follows the time series for example, at the time of motion playback.
[0181] C-2. A behavior edit subsystem behavior edit subsystem is a subsystem for creating and editing, a robot's action sequence, i.e., behavior.
[0182] As already explained, referring to drawing 6 - drawing 8 , it is constituted by putting two or more commands, i.e., action, in order, a robot's action sequence, i.e., behavior. Action is reproduced from a start to an end in an one direction. On the other hand, behavior can specify the sequence which reproduces action. Furthermore, conditional judgment can be performed based on the input from a sensor etc., and the flow of action starting can be branched. Moreover, creation and the editing task of complicated behavior can be made easily and efficient by carrying out grouping of two or more actions and branches, and making it function as a subroutine.
[0183] The thing of the file which specifies behavior is called a "behavior file." File reference may be carried out or you may make it read the content of action used in behavior.
[0184] The graphical user interface which can components-ize action to be used and can be dealt with by mouse actuation, i.e., a "behavior editor", is used for the behavior edit subsystem in this example. behavior arranges two or more actions which are the component -- **** -- since it is constituted, the format of a flow chart editor is used for a behavior editor in appearance. On a behavior editor screen, conditional judgment can be formed in connection between actions, or a loop formation can be formed, or grouping of the array of two or more actions can be carried out, and a definition can be given as components. However, the after-mentioned is yielded about the detail of the behavior edit display which a behavior editor offers.
[0185] The functional configuration of a behavior edit subsystem is typically shown in drawing 19 . As shown in this drawing, especially the behavior edit subsystem concerning this example is designed for [of behavior] edits, and consists of the behavior editorial department and a user interface control section which realizes the editing task of the user by each [these] functional module by the dialogic operation by the GUI screen.
[0186] The behavior editorial department completes (refer to drawing 6 -8) and one behavior by arranging two or more actions by using as components action created in the action edit subsystem.
[0187] The behavior editorial department can choose the box showing the actuation, i.e., action, to mean from a library. Selection of action from a library is performed through the

action selection section. On a screen, an action setting-out window is shown a pop-up table by starting of the action selection section. On an action setting-out window (after-mentioned), the detail of action can be specified by dialogic operation. Specified action is arranged as a box on an edit display.
[0188] When carrying out grouping of the array of two or more actions and giving a definition as components, it is carried out by calling the group registration section. On a screen, a group setting window is shown a pop-up table by starting of the group registration section, and a group's detail can be specified by dialogic operation. A group is registered into a library through the group registration section, it can be henceforth dealt with like action as components which constitute behavior, and it is displayed as a box on an edit display.
[0189] Behavior can include the conditional judgment for branching in the branching list to two or more actions of consecutiveness besides mere connection of actions, or can form the loop formation of action.
[0190] When connecting action, the terminal for connection is formed in a connection side list to each action a connected side. Formation of a terminal is performed by the terminal setting-out section. By starting the terminal setting-out section, on an edit display, a terminal setting-out window is shown a pop-up table, and the detail of a terminal can be specified. Moreover, on a behavior edit display, actions which correspond by dragging the terminals of a box can be connected.
[0191] When a certain action sets up branching to two or more actions, the branching setting-out section is called. On an edit display, a branching setting-out window is shown a pop-up table by starting of the branching setting-out section, and the detail of branching can be specified.
[0192] The conditioning section is called when setting up conditions for a certain action to progress to consecutive action. On an edit display, a conditioning window is shown a pop-up table by starting of the conditioning section, and the detail of conditional judgment can be specified.
[0193] A behavior edit window is presented on a computer screen by the user interface control section. On this behavior edit window, the program which realizes a certain predetermined function as a whole can be constructed by connecting the box which expresses fundamentally action which is the component of behavior using the branching terminal. Two or more actions in which connection relation was formed are registered as a group, and the box showing a group can be components-ized like an action box, and can be dealt with on a behavior edit window. The format of a flow chart editor is used for a behavior edit window by the appearance top.
[0194] The configuration of a behavior edit window is roughly shown in drawing 20 .
[0195] A behavior edit window consists of a title bar, a menu bar, a tool bar, and an edit field that can connect action and a group with a branching terminal and can edit a program in a flow chart edit format as a graphic display.
[0196] Each menu a "file", "edit", an "object", a "tool", a "display scale factor", and "a help" is prepared for the menu bar.
[0197] If a menu "a file" is chosen, the pull down menu which becomes "new behavior", "behavior being opened", "behavior preservation", "behavior new preservation", and a list from each sub menu of "closing" will appear further (refer to drawing 21).
[0198] Selection of a sub menu "new behavior" generates new behavior. When non-saved

action is already opened, the dialog (not shown) which carries out the prompt of the check of whether to save the behavior to a user appears.
[0199] Selection of a sub menu "behavior is opened" opens the existing behavior file. When non-saved behavior is already opened, the dialog which carries out the prompt of the check of whether to save the behavior to a user appears (same as the above).
[0200] Selection of a sub menu "behavior preservation" overwrites the corresponding behavior file. In the case of a non-permanent file, like behavior new preservation (after-mentioned), a file setting-out dialog appears and the prompt of the input of a file name is carried out to a user.
[0201] If a sub menu "behavior new preservation" is chosen, a file setting-out dialog (not shown) will appear and the prompt of the input of a file name will be carried out to a user.
[0202] Selection of a sub menu "it closes" closes the behavior edit window under starting. When the behavior file in this window has not been saved, a dialog appears and the prompt of the check of whether to save this is carried out to a user (same as the above).
[0203] Moreover, if a menu "edit" is chosen, the pull down menu which becomes "it returns", "cutoff", "copy", "overwrite attachment", "insertion attachment", and a list from each sub menu "deletion" will appear further (refer to drawing 22).
[0204] Selection of a sub menu "it returns" performs undo processing sequentially from the latest actuation.
[0205] Selection of a sub menu "cutoff" cuts the selected object. The cut data are actually kept temporarily in a clipboard.
[0206] Selection of a sub menu "a copy" copies the selected object. The copied data are actually kept temporarily in a clipboard.
[0207] Selection of a sub menu "overwrite attachment" pastes the object currently kept in the clipboard on a behavior edit field.
[0208] Selection of a sub menu "deletion" deletes the selected object.
[0209] A menu "an object" places the object used as the components for program editors on a behavior edit field, or offers the function for performing actuation to the installed object. The components for program editors are the terminals (branching terminal) for connecting between box-ized action, a branch, a group, or these boxes. These objects serve as a component of a flow chart.
[0210] If a menu "an object" is chosen, the pull down menu which becomes "action is placed", "a new branch being placed", "a new group being placed", "a new terminal being placed", and a list from each sub menu a "property" will appear further (refer to drawing 23).
[0211] If a sub menu "action is placed" is chosen, a file selection dialog (not shown) will appear and the prompt of the selection of an action file will be carried out to a user. Selected action is placed on a behavior edit field as an object, i.e., an "action box." The action is simultaneously registered into a project window (above-mentioned) automatically.
[0212] If a sub menu "a new branch is placed" is chosen, a new branch will be generated and it will place on a behavior edit field, the object, i.e., a "branch box", corresponding to this. A default identifier is attached to a new branch and a user can change this into a suitable identifier.

[0213] If a sub menu "a new group is placed" is chosen, a new group will be generated and it will place on a behavior edit field, the object, i.e., a "group box", corresponding to this. A default identifier is attached to a new group and a user can change this into a suitable identifier.
[0214] If a sub menu "a new terminal is placed" is chosen, a new terminal will be generated and this will be placed on a behavior edit field. A default identifier is attached to a new terminal and a user can change this into a suitable identifier.
[0215] If a sub menu "a property" is chosen, the property dialog of the object chosen will appear. A user can set up the property of the object which corresponds within this dialog. However, about a property dialog, it mentions later.
[0216] In addition, the same function as each sub menu item of an object menu is offered also on a tool bar (after-mentioned).
[0217] A menu "a tool" prepares sub menus, such as the "Arrow tool", a "connection tool", and a "line end tool." Preparation of each sub menu calls the corresponding function. The same function as these sub menus is arranged as a tool box on a tool bar (after-mentioned).
[0218] Moreover, a menu "a display scale factor" is a menu item for choosing the display scale factor of a behavior edit field. In this example, 1/4, 1/2, etc. are preparing twice, twice, 4 times, and 8 times as alternative.
[0219] Moreover, sub menus, such as a topic, and a support web, version information, are contained in the menu "a help" (common knowledge).
[0220] In the tool bar, the object box for calling, the components, i.e., the object, which should put the function used frequently [the "Arrow tool", a "connection tool", a "line end tool" a "magnifier", a "garbage can", etc.] on behavior edit fields, such as a tool box for calling in an instant, "action" and a "group", a "branch", and a "terminal", is arranged.
[0221] If a tool box "the Arrow tool" is specified, the mouse actuation in a behavior edit field will become the normal mode, i.e., the mode to which an object is moved.
[0222] If a tool box "a connection tool" is specified, the mouse actuation in a behavior edit field will become connection mode, i.e., the mode which connects objects.
[0223] If a tool box "a line end tool" is specified, the mouse actuation within a behavior edit field will become line end mode, i.e., the mode in which the connection between objects is cut.
[0224] Assignment of a tool box "a magnifier" carries out the single step [every] enlarged display of the event of a mouse being clicked. Moreover, if a magnifier is clicked pushing a Control key, a single step [every] reduced display will be carried out. The display scale-factor range follows the sub menu item (above-mentioned) prepared within a menu "a display scale factor."
[0225] If a tool box "a garbage can" is specified, the object by which the mouse was clicked can be deleted from a behavior edit field.
[0226] Each tool box "the Arrow tool", a "connection tool", a "line end tool", and a "magnifier" are chosen exclusively.
[0227] By dragging a box "action" in a behavior edit field from a tool bar, a new action box is put on a drag place. The property dialog for being able to come, simultaneously setting up the detail of this new action appears on a screen.
[0228] In drawing 24 , the property dialog for specifying the detail of an action box is illustrated. It is called by dragging the action box in a tool bar to a behavior edit field, and

also the property dialog for this action setting out can be started via the sub menu item "a property" of a menu "an object."
[0229] A user can specify the identifier of an action box by inputting a character string into the identifier field on the dialog of a graphic display. Moreover, the comment about this action box can be filled in on a comment field.
[0230] Whether the direct input of the command name and command parameter of RCODE is carried out into combo boxes, such as Action, Part, Sound, and Volume#, furthermore, or the right end of this box By choosing a desired command or a desired command parameter from the list box (not shown) which pushes a carbon button and appears, one line, i.e., the RCODE command for one step, can be set up.
[0231] If the RCODE command for one step is set up using combo boxes, such as these Action(s), Part, Sound, and Volume#, and a carbon button [additional (A)] is clicked further, sequential registration will be carried out on a command list.
[0232] Moreover, it is on this command list, and after choosing a predetermined line, by clicking [modification (M)] carbon button, the line concerned serves as an object for modification, and that content of setting out is displayed on each combo box, such as Action, Part, Sound, and Volume#. Moreover, it is on this command list, and after choosing a predetermined line, the line concerned can be deleted from a command list by clicking [deletion (D)] carbon button.
[0233] And if assignment of the detail of a box of operation is completed on this dialog, while the content of assignment which minded the screen by clicking the closed [(C]) carbon button will be registered as a manipulation routine described by RCODE, this dialog closes.
[0234] Moreover, a new branch box is put on a drag place by dragging a box "a branch" in a behavior edit field from a tool bar. The property dialog for being able to come, simultaneously setting up the detail of this new branch appears on a screen.
[0235] In drawing 25 , the property dialog for specifying the detail of a branch box is illustrated. It is called by dragging the branch box in a tool bar to a behavior edit field, and also the property dialog for this branch setting out can be started via the sub menu item "a property" of a menu "an object."
[0236] A user can specify the identifier of a branch box by inputting a character string into the identifier field on the dialog of a graphic display. In the example of a graphic display, "mode branching" is filled in as an identifier of the branching box concerned. Moreover, the comment about this branch box can be filled in on a comment field.
[0237] Whether the direct input of the command name and command parameter of RCODE is carried out into combo boxes, such as Type and Variable, furthermore, or the right end of this box By choosing a desired command or a desired command parameter from the list box (not shown) which pushes a carbon button and appears, the RCODE command which describes the conditional judgment of the branching box concerned can be set up.
[0238] If the RCODE command of branch condition is set up using combo boxes, such as these Type(s) and Variable, and a carbon button [additional (A)] is clicked further, sequential registration will be carried out on a command list.
[0239] Moreover, it is on this command list, and after choosing a predetermined line, by clicking [modification (M)] carbon button, the line concerned serves as an object for modification, and that content of setting out is displayed on each combo box, such as

Type and Variable. Moreover, it is on this command list, and after choosing a predetermined line, the line concerned can be deleted from a command list by clicking [deletion (D)] carbon button.
[0240] And if assignment of the detail of a branch box is completed on this dialog, while the content of assignment will be registered by clicking the closed [(C]) carbon button as a manipulation routine described by RCODE, a dialog closes.
[0241] By using a branch box, processing can be branched according to a sensor input or a user variable value.
[0242] Moreover, a new group box is put on a drag place by dragging a box "a group" in a behavior edit field from a tool bar. The property dialog for being able to come, simultaneously setting up this new group's detail appears on a screen.
[0243] In drawing 26 , the property dialog for specifying the detail of a group box is illustrated. It is called by dragging the action box in a tool bar to a behavior edit field, and also the property dialog for these group setting can be started via the sub menu item "a property" of a menu "an object."
[0244] On the dialog shown in this drawing, a group name and the identifier given to a group box in a behavior edit field (displayed) can be set up.
[0245] Moreover, a new terminal box is put on a drag place by dragging a box "a terminal" in a behavior edit field from a tool bar. The property dialog for being able to come, simultaneously setting up the detail of this new terminal appears on a screen.
[0246] In drawing 27 , the property dialog for specifying the detail of a terminal box is illustrated. It is called by dragging the terminal box in a tool bar to a behavior edit field, and also the property dialog for this terminal setting out can be started via the sub menu item "a property" of a menu "an object." The identifier given to a terminal (displayed) can be set up on the dialog shown in this drawing.
[0247] By clicking the connection tool in a tool bar, it is as having already stated that between each box in a behavior edit field is connectable. In case between boxes is connected, the conditions for judging authorization/disapproval of connection can be set up. What is necessary is just to call the dialog for setting up conditions (Condition) to set up decision conditions.
[0248] In drawing 28 , the property dialog for specifying the detail of connection conditions is illustrated. The property dialog for these conditioning can be started via the sub menu item "a property" of a menu "an object." Within this dialog, the combination of two or more conditions (the example of a graphic display a maximum of four conditions) of having used the AND (AND), the OR (OR), etc. can be set up as connection conditions.
[0249] Subsequently, program editor processing in a behavior edit field is explained.
[0250] In this edit field, drag-and-drop actuation of each object is permitted. Each object, such as action, and a group, a branch, is components-ized in the format of a "box", and a user can construct the program which is described by the connection relation of a box and which realizes a certain function as a whole through the activity which repeats the connection and cutting between boxes by drag-and-drop actuation between each boxes. The format of a flow chart editor is used for an editing task by the appearance top.
[0251] On a new behavior edit window as shown in drawing 20 , terminal "START" which shows a program and initiation of a routine, and terminal "RETURN" which shows a program and termination of a routine to a list can be placed by drag-and-drop actuation

of a terminal box (drawing 29).
[0252] Dropping a terminal box on a behavior edit field can be interlocked with, a property dialog as shown in drawing 27 can start, and the detail of a terminal can be set up.
[0253] RETURN meant the output terminal of a program or a routine and one program and routine may be equipped with two or more output terminals as the graphic display.
[0254] A branch box can be placed on a behavior edit field at an action box list by drags and drops an action box and a branch box from a tool bar to a behavior edit field. Under the present circumstances, the property dialog (refer to drawing 24 and drawing 25) for setting up the detail of action or a branch is shown a pop-up table. The identifier of action assigned to an action box can be specified on each property dialog, a group's identifier assigned to a group box can be specified, or an identifier can be given to a new branch box. Signs that the action box and the group box branch box have been arranged on a behavior edit field are shown in drawing 30 .
[0255] As shown in drawing 30 , each box consists of a box body with which the box name was displayed, the input terminal section of the box which adjoins the upper bed of this box body, and the output terminal section which adjoins the soffit of a box body.
[0256] Furthermore, a behavior edit field serves as connection mode by clicking the connection tool in a tool bar. Under this mode of operation, the connection relation between boxes can be formed by carrying out drag actuation of between the output terminal section of a certain box, and the input terminal sections of other boxes.
[0257] In case between boxes is connected, the conditions for judging authorization/disapproval of connection can be set up. What is necessary is just to call the dialog (to refer to drawing 28) for setting up conditions (Condition) to set up decision conditions.
[0258] Signs that connection relation was formed between each box, such as an action box arranged on a behavior edit field and a group box branch box, are shown in drawing 31 .
[0259] It means that the routine which constitutes a part of program which realizes a certain predetermined function, or program was constructed on the behavior edit field by setting the connection relation between each box as the arrangement list of the box to be used. On a behavior edit field, since a program and a routine are displayed in a format similar to a flow chart, a user can edit a desired program and a desired routine pessimistically easily and intuitively in the format of editing a flow chart.
[0260] By registering as a group the routine constructed in the shape of a flow chart on the behavior edit field, it becomes possible to treat this as components, i.e., an object, like action, the existing group, etc. For example, in case other programs and routines (high order) are built, the group who newly registered can be used.
[0261] For example, grouping of the program or routine formed on the behavior edit field as shown in drawing 31 can also be carried out.
[0262] Signs that the group box which carried out grouping of the program or routine formed in drawing 32 on the behavior edit field shown in drawing 31 has been arranged to the behavior edit field are shown. for example, this group -- receiving -- "Group_012" -- suppose that the group name was given. Group_012 are equipped with one input terminal and three output terminals so that drawing 31 may also show.
[0263] The program (not shown) which used Group_012 as the part, i.e., the routine, of

components can be constructed by arranging other object boxes, such as action, and a group, a branch, on a behavior edit field, and connecting these boxes and Group_012 with a terminal.
[0264] Moreover, the detail of the group who once edited and registered can be opened to a behavior edit field, and an editing task can be performed further. In drawing 33 , signs that the group box shown in drawing 32 was opened are illustrated.
[0265] It has explained in detail about this invention, referring to a specific example more than [addenda]. However, it is obvious that this contractor can accomplish correction and substitution of this example in the range which does not deviate from the summary of this invention.
[0266] Although explained in detail in this example about the authoring system which mentions as an example the pet mold robot which performs quadrapedalism which imitated the dog, and starts this invention, the summary of this invention is not limited to this. for example, a leg formula mobile robot of 2 pairs of shoes like a humanoid robot -- or please understand enough that this invention is applicable similarly also to migration mold robots other than a leg formula.
[0267] Moreover, the "multi-joint structure" indicated by the column of the [claim] of this description is not limited to a physical machinery like many articulated robots including a leg formula robot. For example, it is also possible to apply the authoring system which starts this invention for creation and edit of the operating sequence of the animation using the character generated by computer graphics.
[0268] In short, with the gestalt of instantiation, this invention has been indicated and it should not be interpreted restrictively. In order to judge the summary of this invention, the column of the claim indicated at the beginning should be taken into consideration.
[0269]
[Effect of the Invention] As a full account was given above, according to this invention, the outstanding authoring system and the outstanding authoring approach of supporting creation and edit of the data according to a predetermined scenario can be offered.
[0270] Moreover, according to this invention, the outstanding authoring system and the outstanding authoring approach of supporting creation and edit of a series of command/data which describe a robot's predetermined pattern of operation can be offered.
[0271] Moreover, according to this invention, the outstanding authoring system and the outstanding authoring approach of supporting creation and edit of a pattern of operation using the set of the components which specify a robot's operating state can be offered.
[0272] Moreover, while according to this invention components-izing actions of the robot which consists of combination of one or more time series data, such as actuation of each joint actuator, and arranging on a computer display, the outstanding authoring system and the outstanding authoring approach of performing creation and edit of a robot's behavior by specifying the joint relation of each action by GUI actuation on a display can be offered.
[0273] According to the authoring system and the authoring approach concerning this invention, the tool which can treat the multi-joint structures including a robot as new play can be offered. According to this invention, even if there is no advanced information about computer programming, action of the multi-joint structures including a robot can be programmed, and contents can be created easily. For example, if a user can use it as a

tool for expressing the multi-joint structure and it puts in another way, he can extend the world which a robot offers.
[0274] According to the authoring system and the authoring approach concerning this invention, a user can perform programming about the action sequence of the multi-joint structure in a flow chart editor format through GUI actuation. Furthermore, programming on a GUI screen can be made still easier and efficient by having a variety of libraries in stock to abundance.

[Translation done.]

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the authoring system and the authoring approach for supporting creation and edit of the data according to a predetermined scenario, and relates to the authoring system and the authoring approach of supporting creation and edit of a series of command/data which describe a robot's predetermined pattern of operation especially.
[0002] Furthermore, this invention relates to the authoring system and the authoring approach of supporting creation and edit of a pattern of operation using the set of the components which specify a robot's operating state in detail. While components-izing actions of the robot which consists of combination of one or more time series data, such as actuation of each joint actuator, and arranging on a computer display especially It is related with the authoring system and the authoring approach of performing creation and edit of a robot's behavior by specifying the joint relation of each action by GUI actuation on a display.
[0003]

[Translation done.]

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PRIOR ART

[Description of the Prior Art] The thing of the machinery which performs motion modeled on actuation of human being using the electric or magnetic operation is called "robot." It is said that a robot's origin of a word originates in ROBOTA (slave machine) of a slab word. Although it was in our country that a robot began to spread from the end of the 1960s, the many were the industrial robots (industrial robot) in works aiming at automation, full automation, etc. of production, such as a manipulator and a carrier robot.
[0004] Recently, the researches and developments about the structure of leg formula mobile robots, such as a robot (humanoid robot) of "the human form" which imitated the body mechanism of the animal which performs 2-pair-of-shoes walks in erect posture, such as a pet mold robot which imitated the body mechanism of the animal of quadrapedalism and its actuation like a dog or a cat or Homo sapiens, and an ape, and actuation, or "a human mold", or its stable walk control progress, and the expectation for utilization has also been growing. although these leg formula mobile robot compares with a crawler type robot, it is unstable and attitude control and walk control become difficult -- rise and fall of a stairway and an obstruction -- getting over -- etc. -- it excels in the point that flexible walk / transit actuation is realizable.
[0005] Like an arm type robot, the robot of a deferment type which is implanted and used for a certain specific location works only in fixed and local workspaces, such as assembly, a sorting activity, etc. of components. On the other hand, the robot of workspace of a portable type is un-restrictive, and he can move free in a predetermined path or non-path top, and the human activity of predetermined or arbitration can be executed by proxy, or he can offer the various services which replace Homo sapiens, a dog, or other life objects.
[0006] As one of the applications of a leg formula mobile robot, vicarious execution of various kinds of difficulty activities in an industrial activity, a production activity, etc. is mentioned. For example, it is vicarious execution of the maintenance in a nuclear power plant, a thermal power station plant, and a petrochemical plant, conveyance and assembly operation of the components in a plant, cleaning in a skyscraper, and the risk activity and difficulty activity like the rescue in a fire site and others etc.
[0007] Moreover, the application of "symbiosis" or "entertainment" of a life adhesion mold, i.e., human being, is mentioned rather than above-mentioned activity exchange as other applications of a leg formula mobile robot. This kind of robot emulates the rich feeling expression using the mechanisms of operation and the limbs of a leg formula ambulatory exercise with comparatively high intelligence, such as Homo sapiens or a dog (pet). Moreover, it is also required that the lively response expression which it not only performs faithfully the pattern of operation inputted beforehand, but corresponded dynamically to a partner's language and attitudes ("it strikes") should be realized. ["it praises" or "he scolding",]
[0008] The conventional toy machine has the fixed relation between user actuation and response actuation, and cannot change actuation of a toy according to liking of a user. Consequently, a user becomes ********** soon about the toy which repeats

only the same actuation.
[0009] On the other hand, the intelligent robot has the behavioral model and learning model resulting from actuation, and realizes autonomous thinking and motion control by changing a model based on input, such as voice from the outside, and an image, a tactile sense, and opting for actuation. When a robot prepares a feeling model and an instinct model, the autonomous action according to a robot's own feeling and instinct can be expressed. Moreover, when a robot equips a picture input device and voice-input/output equipment and performs image recognition processing and speech recognition processing, it also becomes possible to realize realistic communication with human being on more advanced intellectual level.
[0010] moreover, it answers having detected the stimulus from the outside, such as user actuation, and this model is changed -- namely

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[Translation done.]

EFFECT OF THE INVENTION

By giving the "study effectiveness", or it does not get bored for a user, the pattern of operation which was adapted for liking can be offered.
[0011] The leg formula mobile robot of these days has high information processing capacity, and can regard the robot itself as a kind of computing system. Therefore, the altitude and a series of complicated operating sequences which are constituted by the combination of the pattern of operation realized on a robot or two or more fundamental patterns of operation are built according to the same activity as computer programming.
[0012] Moreover, a robot's diffusion rate will increase increasingly from now on, and it will be expected that a robot permeates deeply not only the industrial world but ordinary homes and everyday life. About the product which pursues entertainment nature, it is especially expected [that a consuming public layer without advanced information about a computer or computer programming purchases and uses a robot in many cases, and].
[0013] Therefore, it is thought desirable to offer the tool for supporting creating and editing a robot's operating sequence comparatively easily and efficiently by interactive processing also for such a general user, i.e., an authoring system.

[Translation done.]

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] The object of this invention is to offer the outstanding authoring system and the outstanding authoring approach of supporting creation and edit of the data according to a predetermined scenario.
[0015] The further object of this invention is to offer the outstanding authoring system and the outstanding authoring approach of supporting creation and edit of a series of command/data which describe the predetermined pattern of the multi-joint structures, such as a robot, of operation.
[0016] The further object of this invention is to offer the outstanding authoring system and the outstanding authoring approach of supporting creation and edit of a pattern of operation using the set of the components which specify a robot's operating state.
[0017] The further object of this invention is to offer the outstanding authoring system and the outstanding authoring approach of performing creation and edit of a robot's behavior by specifying the joint relation of each action by GUI actuation on a display while it components-izes actions of the robot which consists of combination of one or more time series data, such as actuation of each joint actuator, and arranges them on a computer display.

[Translation done.]

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OPERATION

[Means for Solving the Problem and its Function] This invention is made in consideration of the above-mentioned technical problem. The 1st side face The user input section or the step which is the authoring system or approach for supporting creation and edit of the behavior of the multi-joint structure, and receives the command inputted through an

actuation screen from a user, and data, The user presentation section or the step which offers the workplace for creating and editing the behavior of said other joint structure to a user on an actuation screen, It is the authoring system or approach characterized by forming the connection relation of the components of behavior based on the user input on an actuation screen, and providing the program generation section or the step which generates the program which specifies behavior.

[0019] However, it does not especially ask whether the "system" said here means the thing of an object which gathered logically, and two or more equipments (or functional module which realizes a specific function) are in a case with single each equipment and functional module.

[0020] Moreover, the group who combined action and two or more actions, branching, and termination can be included in the component of behavior.

[0021] Moreover, action is constituted by combining the motion data which described serial actuation of each joint of the multi-joint structure, the sound data by which a voice output is carried out to playback of action synchronizing with a time amount target, and the indicator indicative data which described burning/dissipation actuation of a display indicator by which a display output is carried out to playback of action synchronizing with a time amount target synchronous on a time-axis.

[0022] While according to the authoring system or approach concerning the 1st side face of this invention components-izing action and arranging on a computer display, specifying the joint relation of each action by GUI actuation on a display can perform creation and edit of a robot's behavior with the sensation of a flow chart editor. Moreover, behavior can include the playback sequence of action, and conditional branching and a loop formation.

[0023] Even if the information about a program is the user of the general ******** company funeral which is not deep by showing the connection relation between each component of behavior in a flow chart edit format, said user presentation section or step can follow GUI menu manipulation, and can create and edit behavior comparatively easily.

[0024] You may make it said user presentation section or step provide a user with the attribute setting-out screen which sets up attribute information with each detailed component of behavior.

[0025] Moreover, the 2nd side face of this invention is the storage which stored physically the computer software described to perform processing for supporting creation and edit of the behavior of the multi-joint structure on computer system in the computer-readable format. The user input step which receives the command into which said computer software is inputted through an actuation screen from a user, and data, The user presentation step which offers the workplace for creating and editing the behavior of said other joint structure to a user on an actuation screen, It is the storage characterized by forming the connection relation of the components of behavior based on the user input on an actuation screen, and providing the program generation step which generates the program which specifies behavior.

[0026] The storage concerning the 2nd side face of this invention is a medium which offers computer software physically in a computer-readable format to the computer system of the versatility which can perform various program codes, for example. Attachment and detachment of CD (Compact Disc), FD (Floppy Disc), MO (Magneto-

Optical disc), etc., etc. are free for such a medium, and it is a storage of portability. Or it is also technically possible to provide specific computer system with computer software in a computer-readable format via transmission media, such as a network (for a network not to ask distinction of wireless and a cable), etc.
[0027] Such a storage defines the collaboration-relation on the structure of the computer software and the storage for realizing the function of computer software predetermined in a computer system top, or a function. If it puts in another way, by installing predetermined computer software in computer system through the storage concerning the 2nd side face of this invention, on computer system, a collaboration-operation is demonstrated and the same operation effectiveness as the authoring system and the authoring approach concerning the 1st side face of this invention can be acquired.
[0028] The object, the description, and advantage of further others of this invention will become [rather than] clear by detailed explanation based on the example and the drawing to attach of this invention mentioned later.
[0029]
[Embodiment of the Invention] Hereafter, the example of this invention is explained in detail, referring to a drawing.
[0030] A. The appearance configuration of the mobile robot 1 which performs the leg formula walk by the limbs with which operation is presented in this invention is shown in a robot's block diagram 1 . This robot 1 is a mobile robot of the multi-joint mold constituted by using as a model the configuration and structure of an animal of having the limbs as a graphic display. User actuation was answered and the mobile robot 1 of this example can especially do an expression of operation while he has a side face of the pet mold robot designed by imitating the configuration and structure of a dog which are the example of representation of a pet, for example, coexists with human being in human being's living conditions.
[0031] A mobile robot 1 consists of, the idiosoma unit 2, a head unit 3, a tail 4, and Limbs 6A-6D, i.e., leg units.
[0032] The head unit 3 is arranged in the upper bed before abbreviation of the idiosoma unit 2 through the neck joint 7 with a roll, a pitch, and the degree of freedom of each shaft orientations (graphic display) of a yaw. Moreover, the CCD (Charge Coupled Device: charge-coupled device) camera 15 equivalent to the "eye" of a dog, the microphone 16 equivalent to a "lug", the loudspeaker 17 equivalent to "opening", the touch sensor 18 equivalent to tactile feeling, and two or more LED indicators 19 are carried in the head unit 3. The sensor which constitutes a living body's senses besides these may be included.
[0033] The tail 4 is attached in the abbreviation Gokami edge of the idiosoma unit 2 free [a bow or a splash] through the tail joint 8 with the degree of freedom of a roll and a pitch axis.
[0034] The leg units 6A and 6B constitute a forefoot, and the leg units 6C and 6D constitute hind legs. Each leg units 6A-6D consist of combination of the femoral region units 9A-9D and the leg part units 10A-10D, and are attached in each corner of front and rear, right and left of the base of the idiosoma unit 2, respectively. The femoral region units 9A-9D are connected with each predetermined part of the idiosoma unit 2 by the hip joints 11A-11D with a roll, a pitch, and the degree of freedom of each shaft of a yaw. Moreover, it is connected by the knee joints 12A-12D with the degree of freedom of a

roll and a pitch axis between the femoral region units 9A-9D and the leg part units 10A-10D.
[0035] the leg formula mobile robot 1 constituted like a graphic display making the head unit 3 shake vertically and horizontally by driving each joint actuator by the command from a control section mentioned later, or making a tail 4 wag **** -- each -- a foot -- Units 6A-6D -- a synchronization -- it is made to drive cooperatively and actuation of a walk, transit, etc. can be realized.
[0036] In addition, actually, a mobile robot's 1 joint degree of freedom is arranged for every shaft, and is offered by revolution actuation of a joint actuator (not shown). Moreover, the number of the joint degree of freedom which the leg formula mobile robot 1 has is arbitrary, and does not limit the summary of this invention.
[0037] The block diagram of the electrical and electric equipment and control system of a mobile robot 1 is typically shown in drawing 2 . As shown in this drawing, a mobile robot 1 consists of the control section 20 which performs generalization-control of the whole actuation, and other data processing, the I/O section 40, an actuator 50, and a power supply section 60. Hereafter, each part is explained.
[0038] The I/O section 40 contains various kinds of sensors of CCD camera 15 which is equivalent to a mobile robot's 1 eyes as the input section, the microphone 16 equivalent to a lug, the touch sensor 18 equivalent to tactile feeling, or others equivalent to the senses. Moreover, the loudspeaker 17 equivalent to opening or LED indicator 19 which forms the expression of a face by the combination of a flash or the timing of burning is equipped as the output section. These output section can express the user feedback from a mobile robot 1 in the form of [other than a machine motion pattern with a foot etc.].
[0039] A mobile robot 1 can recognize the objective configuration and the color of arbitration which exist on workspace by a camera 15 being included. Moreover, the mobile robot 1 may have further the receiving set which receives dispatch waves other than a vision means like a camera, such as infrared radiation, an acoustic wave, a supersonic wave, and an electric wave. In this case, based on the sensor output which detects each carrier wave, the location and sense from the source of dispatch are measurable.
[0040] An actuator 50 is functional block which realizes machine motion of a mobile robot 1 according to the predetermined motion pattern which a control section 20 orders it, and consists of actuation units prepared for every shafts, such as a roll in each joint, such as the neck joint 7, the tail joint 8, hip joints 11A-11D, and knee joints 12A-12D, a pitch, and a yaw. A mobile robot 1 has the joint degree of freedom of n pieces, therefore an actuator 50 is constituted from the example of a graphic display by n actuation units. Each actuation unit consists of combination of the driver 53 which controls the revolution location and rotational speed of a motor 51 accommodative based on the output of the motor 51 which performs revolution actuation of the circumference of a predetermined shaft, the encoder 52 which detects the revolution location of a motor 51, and an encoder 52.
[0041] A power supply section 60 is a functional module which supplies electric power to each electrical circuit in literal [the] and a mobile robot 1 etc. The mobile robot 1 concerning this example is the autonomous actuation type which used the dc-battery, and a power supply section 60 consists of a charge dc-battery 61 and a charge-and-discharge control section 62 which manages the charge-and-discharge condition of the charge dc-

battery 61.
[0042] The charge dc-battery 61 consists of gestalten of the "battery pack" which package-ized two or more nickel-cadmium battery cels to the cartridge-type.
[0043] Moreover, the charge-and-discharge control section 62 grasps the remaining capacity of a dc-battery 61 by measuring the terminal voltage of a dc-battery 61, charge/strength of discharge current, the ambient temperature of a dc-battery 61, etc., and determines an initiation stage, a termination stage, etc. of charge. The initiation and the termination stage of charge which the charge-and-discharge control section 62 determines are notified to a control section 20, and serve as a trigger for a mobile robot 1 to start and end charge operation.
[0044] A control section 20 is equivalent to "brains", for example, is carried in a mobile robot's 1 head unit 3 or idiosoma unit 2.
[0045] The configuration of a control section 20 is further illustrated in the detail at drawing 3 . As shown in this drawing, the control section 20 has the composition that the bus connection of CPU (Central Processing Unit)21 as a Maine controller was carried out to each circuit component, which are memory and others, or a peripheral device. A bus 27 is a common signal-transmission way containing a data bus, an address bus, a control bus, etc. The address (a memory address or I/O Address) of a proper is assigned at each to each equipment on a bus 27. CPU21 can communicate with the specific equipment on a bus 28 by addressing.
[0046] RAM (Random Access Memory)22 is the memory which consisted of volatile memory, such as DRAM (Dynamic RAM), and which can be written in, loads the program code which CPU21 performs, or is used for temporary preservation of the activity data based on an executive program.
[0047] ROM (Read Only Memory)23 is a read-only memory which stores a program and data everlastingly. The self-test test program performed to a mobile robot's 1 power up, the motion-control program which specifies actuation of a mobile robot 1 are mentioned to the program code stored in ROM23.
[0048] The "sensor input-process program" which processes sensor inputs, such as a camera 15 and a microphone 16, the "action instruction program" which generates a mobile robot's 1 action, i.e., a motion pattern, based on a sensor input and a predetermined model of operation, and the "actuation control program" etc. which controls actuation of each motor, the voice output of a loudspeaker 17, etc. according to the generated motion pattern are contained in a robot's 1 control program. High actuation of entertainment nature, such as a "hand", a "rain check", "stability", and utterance of the cry of animals, such as "one one", may be included in the motion pattern generated in addition to usual locomotion and transit motion.
[0049] Moreover, creation and various kinds of edited action sequence programs are included, using an authoring tool as a control program of others of a robot 1. An authoring tool is started under a software execution environment predetermined in the computer system top installed for example, in the robot 1 exterior. However, it explains in detail to the program created and edited by the authoring tool list on this tool, therefore the back.
[0050] Like EEPROM (Electrically Erasable and Programmable ROM), nonvolatile memory 24 consists of memory devices in which elimination re-writing is possible electrically, and it is used in order to hold the data which should be updated serially in

un-volatilizing. Security information, such as a serial number and a cryptographic key, the various models which specify a mobile robot's 1 behavior pattern are mentioned to the data which should be updated serially.

[0051] An interface 25 is equipment for interconnecting with the device besides a control section 20, and making the data exchange possible. An interface 25 performs data I/O between a camera 15, a microphone 16, and a loudspeaker 17. Moreover, an interface 25 is each driver 53-1 in an actuator 50. -- I/O of data or a command is performed in between.

[0052] An interface 25 Moreover, serial interface, such as RS(Recommended Standard)-232C, Parallel interfaces, such as IEEE (Institute of Electrical and electronics Engineers)1284, A USB (Universal Serial Bus) interface, An i-Link (IEEE1394) interface, a SCSI (Small Computer System Interface) interface, It has a general interface for peripheral-device connection of computers, such as a memory card interface, and may be made to perform program and migration of data between the external instruments by which local connection was made.

[0053] Moreover, as other examples of an interface 25, it has an infrared-ray-communication (IrDA) interface, and may be made to radiocommunicate with an external instrument.

[0054] Furthermore, a control section 20 can perform an external host computer 100 and data communication via contiguity radiocommunication as shown in "bluetooth" or ".11B" or LAN (Local Area Network:, for example, Ethernet), or the Internet including the radiocommunication interface 26, Network Interface Card (NIC) 27, etc.

[0055] One object of the data communication between such a mobile robot 1 and a host computer 100 is calculating a mobile robot's 1 complicated motion control, or operating by remote control using the computer resource of the robot 1 exterior (namely, remoteness).

[0056] Moreover, other objects of this data communication are to supply data and program of the robots 1, such as a model of operation and other program codes, required for motion control to a mobile robot 1 from the equipment of a network course and remoteness.

[0057] Moreover, other objects of this data communication are debugging processings of the real time according using an authoring tool (after-mentioned) to collaboration-actuation with creation, the edited download of the program for robot motion control, the host computer 100 of such a program for motion control, and a robot 1 on a host computer 100.

[0058] A control section 20 may be equipped with the keyboard 29 which consists of a ten key and/or an alphabet key. A keyboard 29 is used in a robot's 1 work site for command input with a direct user, and also it is used for the input of owner authentication information, such as a password.

[0059] The mobile robot 1 concerning this example can perform autonomous (that is, a help does not intervene) actuation, when a control section 20 performs a predetermined motion-control program. Moreover, while having an input unit equivalent to the senses of human beings, such as an image input (namely, camera 15), voice input (namely, microphone 16), and a touch sensor 18, or an animal, it has the intelligence which performs reasonable or emotional action which answered these external inputs.

[0060] The mobile robot 1 constituted as shown in drawing 1 - drawing 3 has the

following descriptions. Namely, [0061] (1) When changing from a certain position to other positions is directed, between each position cannot be changed directly but it can change via an in-between position without the unreasonableness prepared beforehand.
(2) Advice can be received when the position of arbitration is reached by position transition.
(3) Attitude control can be carried out, managing a position independently in each unit unit, such as a head, a foot, and the tail section. Namely, apart from the whole robot's 1 position, a position is manageable for every unit.
(4) A parameter to show the detail of actuation of an instruction of operation can be passed.
[0062] As shown in drawing 3 , the mobile robot 1 concerning this example interconnects with the external host computer 100 via the network. Or the means of communications of radiocommunication (for example, bluetooth and .11B short distance wireless data transmission) or others may connect in the host computer 100.
[0063] On a host computer 100, a predetermined software execution environment is built, under this environment, an authoring tool can be started, and a robot's 1 operating sequence can be created and edited comparatively easily and efficiently by interactive processing. However, about the detail of an authoring tool, it mentions later.
[0064] In drawing 4 , the example of a hardware configuration of a host computer 100 is illustrated typically. Hereafter, each part in a computer 100 is explained.
[0065] CPU (Central Processing Unit)101 which is the Maine controller of a system 100 performs various kinds of applications under control of an operating system (OS). Although OS offers the GUI (Graphical User Interface) environment more preferably, it is good at Windows 98 [UNIX (trademark) or] of U.S. Microsoft/NT, for example.
[0066] CPU101 interconnects with other equipments (after-mentioned) by bus 107 as the graphic display. The memory address or I/O Address of a proper is given to each device on a bus 107, respectively, and access to a specific device is possible for CPU101 by these addresses. Although buses 107 are a data bus, an address bus, and a common signal-transmission way containing a control bus, the example is a PCI (Peripheral Component Interconnect) bus.
[0067] Memory 102 is storage used since the program code performed in a processor 101 is stored or the activity data under activation are stored temporarily. Please understand the memory 102 shown in this drawing to be a thing containing both un-volatilizing and volatilization memory.
[0068] The display controller 103 is an exclusive controller for processing actually the drawing instruction which CPU101 publishes, for example, supports a bit map drawing function equivalent to SVGA (Super Video Graphic Array) or XGA (eXtended Graphic Array). Once it is written in a frame buffer (not shown), the screen output of the drawing data processed in the display controller 103 is carried out at a display 111. Indicating equipments 111 are for example, a CRT (Cathode Ray Tube) display, a liquid crystal display display (Liquid Crystal Display), etc.
[0069] The input device interface 104 is equipment for connecting user input devices, such as a keyboard 112 and a mouse 113, to a system 100. The input device interface 104 answers the coordinate directions input through the key input or mouse 113 by the keyboard 112, and generates interruption to CPU101.
[0070] According to predetermined communications protocols, such as Ethernet, it can

connect with networks, such as LAN (Local Area Network), or the network interface 105 can connect a system 100 to short-distance wireless data transmission like bluetooth or .11B. Generally, the network interface 105 is offered with the gestalt of a LAN adapter card, and the PCI bus slot on a mother board (not shown) equips with it, and it is used.
[0071] In the example shown in drawing 3 , although the host computer 100 interconnects with the robot 1 via wireless data transmission or a network, of course, both may be connected by other means of communications and data migration means. For example, it may be made to perform exchange and migration of data through an archive medium like memory card (memory stick).
[0072] Moreover, on the network, two or more host computers (not shown) are connected in the transparent condition, and the distributed computing environment is built. Distribution of a software program, data contents, etc. is performed on a network. For example, the authoring tool concerning this example, the action sequence program for robots (the action file which serves as base of an action sequence further, a motion file, a sound file, LED actuation file) created and edited by this authoring tool can be distributed via a network. Moreover, network distribution service of such a program/data may be offered the charge or for nothing.
[0073] The external instrument interface 106 is equipment for connecting external devices, such as a hard disk drive (HDD) 114 and the media drive 115, to a system 100. The external instrument interface 106 is based on interface specification, such as IDE (Integrated Drive Electronics) and SCSI (Small Computer System Interface).
[0074] HDD114 is the external storage which carried the magnetic disk as storage support fixed (common knowledge), and excels other external storage in points, such as memory capacity and a data transfer rate. It calls it "install" to the system of a program to place on HDD116 in the condition that a software program can be performed. Usually, the program code of the operating system which a processor 511 should perform, an application program, a device driver, etc. are stored in HDD114 in un-volatilizing. For example, creation and the edited action sequence programs for robots (the action file which serves as base of an action sequence further, a motion file, a sound file, LED actuation file, etc.) are installable on HDD114 using the authoring tool concerning this example, and this authoring tool.
[0075] Moreover, the media drive 115 is equipment for loading with portable mold media, such as CD (Compact Disc), and MO (Magneto-Optical disc), DVD (Digital Versatile Disc), and accessing a data-logging side.
[0076] Portable mold media are used in order to mainly move backing up a software program, a data file, etc. as data of a computer-readable format, and these between systems (that is, a sale, a negotiation, and distribution are included). For example, these portable mold media can be used, and the authoring tool concerning this example, the action sequence program for robots (the action file which serves as an action sequence further, a motion file, a sound file, LED actuation file) created using this authoring tool can be physically circulated and distributed between devices.
[0077] In addition, an example of the host computer 100 as shown in drawing 4 is the compatible machine or succeeding machine of personal computer"PC/AT(Personal Computer/Advanced Technology)" of U.S. IBM. Of course, it is also possible to apply the computing system equipped with other architecture as a host computer 100 concerning this operation gestalt.

[0078] B. In configuration this example of an authoring system, creation and edit of the motion-control program which consists of a series of command/data which describe a robot's 1 predetermined pattern of operation can be done using the authoring tool started on the host computer 100. Moreover, creation and the edited motion-control program are transmitted to a robot 1 side using radiocommunication means, such as bluetooth and .11B, using this authoring tool, and collaboration-actuation with a host computer 100 and a robot 1 performs debugging processing. That is, the authoring system for supporting creation and edit of a mobile robot's 1 motion-control program is built by organic association between a host computer 100 and a robot 1.
[0079] In drawing 5 , the whole authoring system configuration is illustrated typically.
[0080] In a host computer 100 side, a user can use the GUI (Graphical User Interface) screen which an authoring tool offers, and can create and edit the action sequence of a convention of a mobile robot 1 by mouse actuation (however, about the detail of the editing operation on this GUI screen, the after-mentioned is yielded at the GUI screen list for action sequence creation). Or a user can use the usual text editor etc., and can create and edit a robot's 1 motion-control program in a script format (for example, high level language formats, such as C).
[0081] An authoring tool changes the motion-control program of the action sequence which the user created and edited on the GUI screen, and the script format created and edited on the text editor into the mnemonic code of a format similar to the assembler called "RCODE".
[0082] RCODE said here is the programming language upon which it was decided as controlling a robot 1 using an easy command. Since it also has fundamental control structures, such as "IF" and "GO", RCODE can be used also as a minimum level script language for robot controls.
[0083] The RCODE motion-control program created and edited on the host computer 100 is movable to a robot 1 side using media, such as a memory stick. Moreover, at the time of debugging of a RCODE motion-control program, a RCODE program is taken out for every line, and it enciphers, and transmits to a robot 1 side serially using radiocommunication means, such as bluetooth and .11B.
[0084] On the other hand, in the robot 1 side, it has an interpreter/debugger, middleware, the driver, and the operating system (OS) as the motion-control program execution described by RCODE etc., and a debugging environment.
[0085] An interpreter is a high-level-language program which reads at a time the program of one line described in the RCODE format, interprets it, and performs it. However, in the time of debugging etc., when a RCODE program is transmitted in the format enciphered from the host computer 100 side, once an interpreter decrypts this, it needs to perform interpretation and activation.
[0086] A debugger discovers the error in a RCODE program (bug), and is a program which supports the activity which corrects. That is, according to the debugger, activation can be stopped in the line which specified the program, or the memory at that time and the content of the variable can be referred to.
[0087] Middleware is a meeting of a software module which offers a robot's 1 fundamental function, and the configuration of each module is influenced of hardware attributes, such as a robot's 1 mechanical and electric property and specification, and a configuration. Middleware is functionally divided roughly into the middleware of a

recognition system, and the middleware of an output system.
[0088] The middleware of a recognition system is an engine which receives raw data from hardware, such as image data, voice data, and detection data obtained from other sensors, via a virtual robot, and processes these. That is, based on various input, speech recognition, distance detection, position detection, contact, motion detection, color recognition, etc. are processed, and a recognition result is obtained. A recognition result is notified to the application layer (action sequence program) of a high order.
[0089] On the other hand, in the middleware of an output system, functions, such as a walk, playback of a motion, composition of an output sound, and flash control of a LED indicator, are offered. That is, the action plan drawn up in the application layer is received, the servo command value of each fastener of a robot, an output sound, output light (LED), output voice, etc. are generated for every function of a robot 1, and it demonstrates on a robot 1.
[0090] A driver is a program code for operating hardware of each joint actuator or others.
[0091] In this example, the driver is mounted in the middleware list by the object-oriented program. The software based on object-oriented is fundamentally treated in the module unit of the "object" which made the processing procedure over data and its data unify. Moreover, if needed, two or more objects are created or one software is completed by combining. Generally, according to the object oriented programming, it is thought that the efficiency of development and maintenance of software is increased.
[0092] An operating system (OS) performs control about management of the data communication between these objects, and other program executions. OS is also mounted by the object-oriented program.
[0093] C. The scenario of operation created using the authoring tool concerning creation / edit this example of the program for robots of operation using an authoring tool is realized in creation and edit of "behavior", and creation and edit of "action." The information which is needed in order to make behavior and action is summarized to the file called a "project", and is managed.
[0094] Action is constituted by unifying each contents called the motion file and sound file by which the synchronization was taken on the time-axis, and an LED actuation file. One action file is a command (it is also called "semantics") reproduced in general in about 10 seconds.
[0095] A motion file is a file which specifies actuation of each joint actuator of a mobile robot 1. By this example, by arranging serially two or more key frames which described signs that the mobile robot 1 was made to take a desired pause on the GUI edit display can prescribe a motion (after-mentioned).
[0096] A sound file is sound data for carrying out a voice output through a loudspeaker 17, for example, is constituted as a file of MIDI (Musical Instrumental Digital Interface) or a WAVE format. For example, the sound file described in the MIDI format is not as information on the sound itself, performance information, such as magnitude, die length, a tone, and effectiveness, can be changed into numeric data, and music can be expressed. In this example, performance information can be edited by operating each numeric data of the MIDI format which constitutes sound through a GUI edit display (after-mentioned).
[0097] An LED actuation file is data for specifying the combination of burning actuation of two or more LED indicators 19, and the timing of a flash, and is used for the purpose

of forming the expression of a face. In this example, an LED actuation file is described in a MIDI format, and can edit an LED actuation file free through a GUI edit display (after-mentioned).
[0098] In this example, the work environment for the action edit which can take the synchronization between each contents, such as a motion, a sound, and LED actuation, to preparation is offered by using the time line on the action edit display of a GUI format so that it may mention later. Moreover, each contents can be processed as each data, and also it can be dealt with as the format, i.e., a format of action, unified with other contents.
[0099] "Behavior" is a file which is constituted by putting two or more commands, i.e., action, in order and which specifies behavior of a mobile robot 1 (refer to drawing 6). Action is reproduced from a start to an end in an one direction. On the other hand, behavior can specify the sequence which reproduces action. Furthermore, it can box-ize, branching (refer to drawing 7) based on conditions or a probability, and two or more commands, i.e., action, and a subroutine can be defined (refer to drawing 8). Therefore, behavior can be compared with action and can describe a mobile robot's 1 complicated action sequence with altitude more.
[0100] A project holds the reference list of a mobile robot's 1 configuration (CPC:Configured Peripheral Component), the behavior file made on an authoring system, and action files. Moreover, a project also holds the reference list of a raw material (contents) and files required in order to make an action file (namely, a motion, a sound, LED actuation). Hardware Configuration Information which serves as a configuration said here from the combination of the physical component of the robots 1, such as a fuselage, a head, and the leg, is set up.
[0101] At the time of project edit, a "project window" as shown in drawing 34 is displayed. In a project window, the list of each files, such as a behavior file used for edit of action, an action file, a motion file, a sound file, and an LED actuation file, is displayed on the edit list of behavior in a tree format as a graphic display.
[0102] Functionally, the authoring system concerning this example consists of an "action edit subsystem" into which it edits, the command, i.e., action, which consists of each contents, such as a motion, a sound, and LED actuation, and a "behavior edit subsystem" into which a robot's behavior is edited by putting two or more commands, i.e., action, in order.
[0103] C-1. An action edit subsystem action edit subsystem is a subsystem for creating and editing each action used, a robot's action sequence, i.e., behavior.
[0104] Action has the time die length for performing action, and specifies an initial pause and the last pause. Action is constituted by setting out in LED actuation etc. with a motion (motion) of the robot within the execution time, and a sound. The thing of the file which specifies action is called an "action file." Reading from the outside of a file is sufficient as contents, such as a motion which action uses, a sound, and LED actuation.
[0105] The action edit in this example adopts the graphical user interface, i.e., an "action editor", centering on the edit which followed on the time-axis so that it may mention later. In action edit, 3D edit of the pause which specifies a motion, a sound, LED actuation, etc. edit each contents. These contents are time series data, and since the channel which displays each contents is arranged along with a time-axis and he is trying to display it on the time table of a two-dimensional time-line format, creation and edit of an action edit subsystem can be done, checking the synchronization between each time

series data visually.
[0106] The functional configuration of an action edit subsystem is typically shown in drawing 9 . As shown in this drawing, especially the action edit subsystem concerning this example is designed for [of action] edits, and consists of the action editorial department, the key frame editorial department, the motion editorial department, the sound editorial department, the LED actuation editorial department, and a user interface control section that realizes the editing task of the user by each [these] functional module by the dialogic operation by the GUI screen.
[0107] The action editorial department is a functional module for editing a motion file, a sound file, and an LED actuation file in the format that a synchronization is taken on a time-axis. The action editorial department shows a user the action edit window for setting up the timing of the joint actuation (motion) in alignment with a mobile robot's 1 time-axis, and a sound and LED actuation through a user interface control section. The action edit window is equipped with the edit field which consists of a table of the time-line format for setting up various kinds of files on a time-axis.
[0108] The key frame editorial department is a functional module for editing a key frame, i.e., the image frame which described the pause in the time of day when the mobile robot which performs a motion corresponds. The key frame editorial department is answered and called to the user actuation to the action editorial department, and the editing task by the user is received through the key frame channel opened on an action edit window. By the key frame channel, the thumbnail showing a key frame is put on each location where it corresponds on a time-axis.
[0109] The motion editorial department is a functional module for editing serial actuation of each joint actuator which constitutes a motion, i.e., a mobile robot. The motion editorial department is answered and called to the user actuation to the action editorial department, and the editing task by the user is received through the motion channel opened on an action edit window. By the motion channel, each timing chart which describes serial actuation of each joint actuator is listed in the shape of a tree according to biomodel (tree view).
[0110] The sound editorial department is a functional module for setting up the detail of the sound which is one of the components of action. In this example, a sound is treated in a MIDI format or a WAVE format. The sound editorial department shows a user the sound detail window for setting up the detail of a sound along a time-axis top through a user interface control section. The sound detail window is equipped with the edit field which consists of a table of the two-dimensional time-line format which consists of a lateral time-axis and a channel of a lengthwise direction (after-mentioned).
[0111] The LED actuation editorial department is a functional module for setting up the detail of the LED actuation which is one of the components of action. In this example, LED actuation is treated in a MIDI format. The LED actuation editorial department shows a user the LED detail window for setting up the detail of LED actuation along a time-axis top through a user interface control section. The LED detail window is equipped with the edit field which consists of a table of the two-dimensional time-line format which consists of a lateral time-axis and a channel of a lengthwise direction (after-mentioned).
[0112] A user interface control section shows a user a project window (above-mentioned) at the time of project edit.

[0113] Moreover, a user interface control section answers the user directions through each edit window, and can access now each file system (or database) which manages a behavior file, an action file, a motion file, a sound file, and an LED actuation file.
[0114] The configuration of an action edit window is roughly shown in drawing 10 . On this action edit window, the timing of the joint actuation (motion) in alignment with a mobile robot's 1 time-axis, and a sound and LED actuation can be set up. The edit result in this edit window is saved as an action file with extension "act".
[0115] The edit field of an action edit window is the table of the two-dimensional time-line format which consists of a lateral time-axis and a channel of a lengthwise direction as a graphic display. In a time-line table, it consists of a time amount ruler, a key frame channel, a motion channel, a sound channel, and an LED actuation channel.
[0116] A time amount ruler can change the frame number display with a real-time display using a unit change radio carbon button (the real-time display is chosen in the example shown in drawing 10). The unit of the graduation of a real-time display is considered as a second:ms (double figures each) display.
[0117] The time amount ruler includes the end time field and the current time stamp field other than a unit change radio carbon button.
[0118] The time-of-day numeric value which shows the end time (namely, operating time) of action under edit is displayed on the end time field (in the example of a graphic display, "09:40" (=9 second 40) is displayed). Moreover, the time-of-day numeric value of a current location is displayed on the current time stamp field (in the example of a graphic display, "04:60" (=4 second 60) is displayed). If the time-of-day figure which is the text field which can be edited and is meaningful is inputted, it becomes end time, the last key frame will move or current time of day will move these fields to the location.
[0119] In an edit field, a "key frame line", and the "last time stamp line" and a "current time-of-day line" are displayed as a time stamp line, respectively.
[0120] The key frame line which shows the time of day of each key frame is made to be displayed in the form which crosses each channel top. Therefore, a user can perform an editing task, checking the synchronization between each contents called a motion, a sound, and LED actuation visually.
[0121] Moreover, since he is trying for the end time line which shows the end time of action under edit to display each channel top in the crossing form, a user can understand visually the range of the time amount used as the object for edit. An end time line can also be caught with the last pause key frame line.
[0122] Moreover, he is trying for the current time-of-day line which shows current time to display each channel top in the crossing form. Fundamentally, a click of on one of channels moves current time of day to the location.
[0123] A key frame channel is a field for displaying a key frame according to the time-axis which a time amount ruler specifies.
[0124] In the example shown in drawing 10 , switching operation is possible for a key frame channel. The action edit window in the condition (key frame detail channel) of having opened the key frame channel is shown in drawing 11 . By the key frame channel, the thumbnail showing a key frame is put on each location where it corresponds on a time-axis. The "key frame" said here is an image frame which described the pause in the time of day when the mobile robot which performs a motion corresponds.
[0125] An initial pause and the last pause are special key frames located in the start of a

key frame channel, and an end, respectively. The key frame of the beginning and the last is placed beforehand.
[0126] On a key frame channel, the frame (henceforth a "interpolation frame") interpolated by the key frame of the ends which sandwich this time amount will be reproduced by the time amount by which the key frame is not arranged. A interpolation frame is not displayed on a key frame. In the authoring system concerning this example, when each key frame is arranged on a key frame channel, a motion which connects smoothly the pause described by each key frame is generated automatically by computer processing. Moreover, the center of gravity of 3D model can be set up by each key frame, and the motion on the appearance of 3D model can be made into the thing near the system.
[0127] Each key frame is arranged on a key frame channel so that the left end of a thumbnail may serve as time of day of a key frame. Moreover, by dragging a thumbnail to right and left along with a time-axis, it follows, and a key frame line can move and can change the time of day of the corresponding key frame. Moreover, telescopic motion of the key frame of the last pause turns into telescopic motion of the whole action time amount.
[0128] If a thumbnail is double-clicked, the pause edit window of the corresponding pause can open and a pause can be edited. However, an initial pause and the last pause are the outsides for edit, and even if it double-clicks these, there is no pause edit window in open.
[0129] A motion channel is a field for meeting the time-axis which a time amount ruler specifies, and editing and displaying the content of the motion.
[0130] In this example, switching operation is possible for a motion channel. The action edit window in the condition (motion detail channel) of having opened the motion channel is shown in drawing 12 . A motion is defined by actuation of each joint actuator which constitutes a mobile robot 1. By the motion channel, each timing chart which describes serial actuation of each joint actuator is listed in the shape of a tree according to biomodel (tree view).
[0131] The line graph on each timing chart shows the motion of the corresponding joint actuator, i.e., the temporal response of angle of rotation. By dragging the crossing point of a key frame line and the polygonal line up and down, the set point in the time amount concerned of the corresponding joint actuator can be changed. Moreover, as a result of such drag actuation, the pause applicable to a key frame line also changes, and renewal of automatic also of the content of the key frame is carried out.
[0132] A sound channel is a field for displaying sound data along with the time-axis which a time amount ruler specifies. In this example, from an action edit window, independent "sound detail window" can be opened and the sound data of a MIDI format can be edited by GUI actuation on this window.
[0133] An LED actuation channel is a field for displaying LED actuation data along with the time-axis which a time amount ruler specifies. In this example, from an action edit window, independent "LED detail window" can be opened and the LED actuation data of a MIDI format can be edited by GUI actuation on this window.
[0134] The configuration of the sound detail window for editing the sound file of a MIDI format is roughly shown in drawing 13 . The edit field of this sound detail window is the table of the two-dimensional time-line format which consists of a lateral time-axis and a

channel of a lengthwise direction as a graphic display. The inside of a time-line table consists of a time amount ruler, a key frame channel, a score channel, and a velocity channel.

[0135] A time amount ruler can change the frame number display with a real-time display using a unit change radio carbon button (the real-time display is chosen in the example shown in drawing 13). The end time field and the current time stamp field other than a unit change radio carbon button are included in the time amount ruler. The time-of-day numeric value which shows the end time of action under edit is displayed on the end time field, and the time-of-day numeric value of a current location is displayed on the current time stamp field. If the time-of-day figure these fields have a meaning is inputted, it becomes end time, the last key frame will move or current time of day will move to the location.

[0136] In an edit field, a "key frame line", and the "last time stamp line" and a "current time-of-day line" are displayed as a time stamp line, respectively. The key frame line which shows the time of day of each key frame (after-mentioned) is displayed in the form which crosses each channel top, and a user can perform the editing task of a MIDI sound, checking the synchronization with a key frame visually. Moreover, since he is trying for the end time line which shows the end time of action under edit to display each channel top in the crossing form, a user can understand visually the range of the time amount used as the object for edit. Moreover, he is trying for the current time-of-day line which shows current time to display each channel top in the crossing form. Fundamentally, a click of on one of channels moves current time of day to the location.

[0137] The key frame location acquired from the action edit window along with the time-axis which a time amount ruler specifies is expressed as a key frame channel.

[0138] A score channel is a field for editing a MIDI sound by GUI actuation, and is constituted by a piano keyboard (however, the effective compass is different with a mobile robot's 1 model), and the basic grid of the direction of a time-axis.

[0139] With a piano keyboard, the maximum compass permitted by a mobile robot's 1 hardware specification etc. by the image display of a piano keyboard is displayed (or refreshable compass is displayed brightly and it may be made to indicate except [its] by gray). [0140] which displays the absolute pitch of sound, such as C3 and C4, on basic C key part The grid of the time amount width of face of the set-up quarter note is displayed on a score part. Moreover, the line of two grids (namely, two rhythm), three grids (three rhythm), and four grids (four rhythm) is emphasized with the value (above-mentioned) set up by rhythm.

[0141] On a score channel, a score is constituted by the height of a piano key with the sound length which becomes the criteria of a time-axis. One grid is called a "cel." A color is attached to a cel with a sound. However, in the case of the playback model of only one sound, a sound cannot be put on the scale from which it differs on the same time-axis. Moreover, a click of an empty cel (that is, the color is not attached) places the sound of the die length of the note mark chosen. When a sound exists in other height on the same time amount, a sound replaces the clicked height. A click of the cel in which a sound already exists removes the sound.

[0142] Note marks, such as 16 diacritical marks, 8 diacritical marks, a quarter note, a half note, a whole note, dotted 8 diacritical marks, a dotted quarter note, and a dotted half note, are displayed on the field on the left-hand side of a piano keyboard. These note

mark shall have an exclusive selection condition mutually, and only any one shall always be chosen. Moreover, a selection item changes with mouse click actuation.
[0143] A velocity channel is a field which displays the strength of the velocity for every sound. In the example shown in drawing 13 , although sound intensity is displayed with a bar graph, it may be displayed by the line graph. The sound intensity in each joint can be depended and adjusted to dragging the maximum upper bed of a bar graph. The maximum sound volume is set up by the default.
[0144] Moreover, the configuration of the sound detail window for displaying the sound file of a WAVE format is roughly shown in drawing 14 . A sound detail window is the table of the two-dimensional time-line format that a title bar, a menu bar, and the edit field of a WAVE formal sound file consist of a lateral time-axis and a channel of a lengthwise direction, as a graphic display. The inside of a time-line table consists of a time amount ruler, a key frame channel, and a WAVE channel.
[0145] A time amount ruler can change the frame number display with a real-time display using a unit change radio carbon button.
[0146] The time-of-day numeric value which shows the end time (namely, operating time) of action under edit is displayed on the end time field. Moreover, the time-of-day numeric value of a current location is displayed on the current time stamp field. If the time-of-day figure these fields have a meaning is inputted, it becomes end time, the last key frame will move or current time of day will move to the location.
[0147] In an edit field, a "key frame line", and the "last time stamp line" and a "current time-of-day line" are displayed as a time stamp line, respectively. The key frame line which shows the time of day of each key frame is displayed in the form which crosses each channel top, and a user can perform the editing task of a WAVE sound, checking the synchronization with a key frame visually. Moreover, since he is trying for the end time line which shows the end time of action under edit to display each channel top in the crossing form, a user can understand visually the range of the time amount used as the object for edit. Moreover, he is trying for the current time-of-day line which shows current time to display each channel top in the crossing form. Fundamentally, a click of on one of channels moves current time of day to the location.
[0148] The key frame location acquired from the action edit window along with the time-axis which a time amount ruler specifies is expressed as a key frame channel.
[0149] As shown in drawing 14 , the contents of the sound file of a WAVE format are expressed as a WAVE channel as a wave.
[0150] Moreover, the configuration of the LED detail window for displaying and editing into drawing 15 the LED actuation file described in the MIDI format is shown roughly. The edit field of a sound detail window is the table of the two-dimensional time-line format which consists of a lateral time-axis and a channel of a lengthwise direction as a graphic display. The inside of a time-line table consists of a time amount ruler, a key frame channel, and a score channel.
[0151] A time amount ruler can change the frame number display with a real-time display using a unit change radio carbon button. The time amount ruler includes the end time field and the current time stamp field other than a unit change radio carbon button. The time-of-day numeric value which shows the end time of action under edit is displayed on the end time field. Moreover, the time-of-day numeric value of a current location is displayed on the current time stamp field. If the time-of-day figure these fields have a

meaning is inputted, it becomes end time, the last key frame will move or current time of day will move to the location.
[0152] In an edit field, a "key frame line", and the "last time stamp line" and a "current time-of-day line" are displayed as a time stamp line, respectively. The key frame line which shows the time of day of each key frame is displayed in the form which crosses each channel top, and a user can perform the editing task of the LED actuation described in the MIDI format, checking the synchronization with a key frame visually. Moreover, since he is trying for the end time line which shows the end time of action under edit to display each channel top in the crossing form, a user can understand visually the range of the time amount used as the object for edit. Moreover, he is trying for the current time-of-day line which shows current time to display each channel top in the crossing form. Fundamentally, a click of on one of channels moves current time of day to the location.
[0153] The key frame location acquired from the action edit window along with the time-axis which a time amount ruler specifies is expressed as a key frame channel.
[0154] A score channel is a field for editing the LED actuation described by GUI actuation in a MIDI format, and is constituted by the list of parts which have arranged LED on mobile-robot 1 body, and the basic grid of the direction of a time-axis. In this example, LED is arranged at least at each part of **** (******), a right eye alpha and a left eye alpha, a right eye beta, a left eye beta, a right eye gamma, a left eye gamma, a tail alpha, and a tail beta.
[0155] On a score channel, the score for every list is constituted at least for each part by displaying the burning situation of LED like each part on a time-axis. One grid is called a "cel." The color and the color according to burning reinforcement are attached to the cel of the location equivalent to the part which LED turns on on a time-axis.
[0156] It is shown in the left of a score channel the LED part visual ** table. This carries out the graphic expression only of each part of LED which can be changed.
[0157] Moreover, the velocity mark is displayed on as visual a lower part as the LED section. A velocity mark is a mark which displayed classes, such as lifting, a high end keeping, and descent. These marks have an exclusive selection condition mutually, and one is always chosen by something. Moreover, a selection item changes with mouse clicks.
[0158] The action edit subsystem concerning this example is preparing the preview window, in order to check visually the content of action edited on the above-mentioned action edit window (refer to drawing 10).
[0159] The configuration of a preview window is roughly shown in drawing 16 . As shown in this drawing, a preview window consists of a "3D view", and the "current time-of-day field" and a "playback carbon button group". [a "3D display change carbon button group", and]
[0160] The three-dimension mobile robot's 1 image generated by computer graphics processing is always displayed on 3D view. By dragging on this view, the direction of a look can be moved and how a view appears can be changed. Moreover, although not illustrated, you may constitute so that 3D model can be simultaneously previewed from two or more views. Moreover, a motion of a view is interlocked with the user input actuation on a 3D display change carbon button group.
[0161] In case creation processing of the 3D display of a motion is carried out, at least each part may be equipped with the collision (collision) of comrades, or the check

function of the actuation rate of each joint with 3D model. Moreover, the center of gravity of 3D model can be set up by each key frame, and the motion on the appearance of 3D model can be made into the thing near the system.
[0162] Moreover, the LED actuation preview field for displaying LED actuation is arranged in the right-hand side of 3D view. In this preview field, it is made to synchronize with a motion of the mobile robot 1 on 3D view mentioned above, and signs that a mobile robot's 1 LED blinks are displayed.
[0163] Each carbon button "a revolution", "zoom-in/out", a "pan", and a "home location" is arranged in the 3D display change carbon button group. A user can change the direction of a look to the robot in 3D view by carrying out click actuation of these carbon buttons.
[0164] For example, if a revolution carbon button is clicked, it will become revolution mode, and if 3D view is dragged henceforth, the mobile robot 1 in 3D view will rotate. Moreover, if zoom-in / out carbon button is clicked, it will become zoom mode, and if 3D view is dragged up and down henceforth, the mobile robot 1 in 3D view will do zoom-in/out. moreover -- if 3D view will become panmode if a pancarbon button is clicked, and 3D view is dragged vertically and horizontally henceforth -- 3D view -- a pan -- that is, high-speed migration is carried out. Moreover, if a home location carbon button is clicked, a mobile robot's 1 three-dimensional display will return to the condition of having seen from the default view of a look, i.e., default direction.
[0165] The current time of day of the content of drawing currently displayed on 3D view is displayed on the current time-of-day field. If the alphabetic character this field has a meaning as time of day is inputted, the display of 3D view will change to the frame of the corresponding time of day. Moreover, the time-of-day location of KARENTO is relatively indicated by visual.
[0166] Each carbon button "rewinding [of a frame]", "a front key frame", "a play/stop", "coma delivery of a frame", "frame delivery", and "loop-formation playback" is arranged in the playback carbon button group.
[0167] If it clicks "rewinding [of a frame]", the display of 3D view will return to the first frame. If "a front key frame" is clicked, the display of 3D view will fly to the last key frame from a current location. Moreover, a click of "a play/stop" starts or suspends playback of 3D view display (during a play, a play/stop button is stopped and acts as a play during a stop). Moreover, if "coma delivery of a frame" is effective only during playback of 3D view display and it is clicked, coma delivery of one frame will be carried out. Moreover, a click of "frame delivery" advances the display of 3D view to the last frame. Moreover, a click of "loop-formation playback" carries out loop-formation playback of the display of 3D view.
[0168] Moreover, the action edit subsystem concerning this example is preparing the pause window, in order to edit a mobile robot's 1 three-dimension-pause by GUI actuation which makes a drag the keynote. The pause edited on a pause window can be used as a key frame which constitutes a motion.
[0169] The configuration of a pause window is roughly shown in drawing 17 . On this pause window, angle of rotation of each joint actuator which constitutes a mobile robot 1 is directly directed by GUI actuation, and a desired pause can be specified simply. A pause window consists of a stereo viewing area, the list appointed field, a set point field, a 3D viewing area, a 3D display change carbon button group, and display change pop up.

[0170] A mobile robot's 1 expansion top view is displayed, and a user is made to choose the part which can be edited in the stereo appointed field. The item of list assignment is chosen, by the 3D display up, it blinks and, as for the selected part, highlighting or the content which is set point area changes.
[0171] In the list appointed field, a mobile robot's 1 part which can be edited and the set point are displayed as a list. if a user chooses a specific part out of this list, in the stereo appointed field, the corresponding part will carry out highlighting -- having -- 3D viewing area -- highlighting -- or it blinks and the content of the set point field changes.
[0172] In the set point field, a list indication of the maximum is given at the setting-out part name of each part which can be edited, the set point, and the minimum value list that can be set up. If a specific part with a user is chosen, the content will change. The set point can be keyed directly in the field which can be inputted. The expression of an include angle can be considered as a radii expression, and the set point can be changed by dragging the line for assignment.
[0173] In 3D viewing area, a mobile robot's 1 whole body image generated by 3D graphics is drawn with a ground surface. A user can choose that part by clicking the part which corresponds from this 3D display, and highlighting of the selection part is carried out. Furthermore, the set point can be directly changed by dragging a selection part.
[0174] The content of a display in 3D viewing area is being interlocked with the 3D display change carbon button, and can change by dragging the view top of this 3D viewing area, the way of a look, i.e., direction, a view appears.
[0175] Each carbon button "a revolution", "zoom-in/out", a "pan", and a "home location" is arranged in the 3D display change carbon button group. A user can change the direction of a look in 3D viewing area by carrying out click actuation of these carbon buttons.
[0176] For example, if a revolution carbon button is clicked, it will become revolution mode, and if 3D viewing area is dragged henceforth, the mobile robot 1 in 3D viewing area will rotate. Moreover, if zoom-in / out carbon button is clicked, it will become zoom mode, and if 3D viewing area is dragged up and down henceforth, a mobile robot 1 will do zoom-in/out within 3D viewing area. moreover -- if it will become panmode if a pancarbon button is clicked, and 3D viewing area is dragged vertically and horizontally henceforth -- the inside of 3D viewing area -- a mobile robot 1 -- a pan -- that is, high-speed migration is carried out. Moreover, if a home location carbon button is clicked, a mobile robot's 1 three-dimensional display will return to the condition of having seen from [default] the look.
[0177] The "O.K." carbon button and "cancellation" carbon button are prepared for the pause window. If the O.K. carbon button is clicked, all the edit items in this window will be confirmed, and this window will be closed. On the other hand, if a Cancel button is clicked, all edit items will be made into an invalid and this window will be closed (common knowledge).
[0178] Moreover, the action edit subsystem concerning this example is preparing the motion pre viewer for previewing the motion edited by the motion channel, or the motion which used as the key frame each pause edited by the POVU window. The configuration of a motion pre viewer is roughly shown in drawing 18 .
[0179] On a motion pre viewer, while previewing a motion, in order to paste on an action edit window, copying a pause is permitted.

[0180] On a motion pre viewer, the thumbnail of one or more key frames, i.e., a pause, which constitute a motion is displayed. The array of a key frame follows the time series for example, at the time of motion playback.
[0181] C-2. A behavior edit subsystem behavior edit subsystem is a subsystem for creating and editing, a robot's action sequence, i.e., behavior.
[0182] As already explained, referring to drawing 6 - drawing 8 , it is constituted by putting two or more commands, i.e., action, in order, a robot's action sequence, i.e., behavior. Action is reproduced from a start to an end in an one direction. On the other hand, behavior can specify the sequence which reproduces action. Furthermore, conditional judgment can be performed based on the input from a sensor etc., and the flow of action starting can be branched. Moreover, creation and the editing task of complicated behavior can be made easily and efficient by carrying out grouping of two or more actions and branches, and making it function as a subroutine.
[0183] The thing of the file which specifies behavior is called a "behavior file." File reference may be carried out or you may make it read the content of action used in behavior.
[0184] The graphical user interface which can components-ize action to be used and can be dealt with by mouse actuation, i.e., a "behavior editor", is used for the behavior edit subsystem in this example. behavior arranges two or more actions which are the component -- **** -- since it is constituted, the format of a flow chart editor is used for a behavior editor in appearance. On a behavior editor screen, conditional judgment can be formed in connection between actions, or a loop formation can be formed, or grouping of the array of two or more actions can be carried out, and a definition can be given as components. However, the after-mentioned is yielded about the detail of the behavior edit display which a behavior editor offers.
[0185] The functional configuration of a behavior edit subsystem is typically shown in drawing 19 . As shown in this drawing, especially the behavior edit subsystem concerning this example is designed for [of behavior] edits, and consists of the behavior editorial department and a user interface control section which realizes the editing task of the user by each [these] functional module by the dialogic operation by the GUI screen.
[0186] The behavior editorial department completes (refer to drawing 6 -8) and one behavior by arranging two or more actions by using as components action created in the action edit subsystem.
[0187] The behavior editorial department can choose the box showing the actuation, i.e., action, to mean from a library. Selection of action from a library is performed through the action selection section. On a screen, an action setting-out window is shown a pop-up table by starting of the action selection section. On an action setting-out window (after-mentioned), the detail of action can be specified by dialogic operation. Specified action is arranged as a box on an edit display.
[0188] When carrying out grouping of the array of two or more actions and giving a definition as components, it is carried out by calling the group registration section. On a screen, a group setting window is shown a pop-up table by starting of the group registration section, and a group's detail can be specified by dialogic operation. A group is registered into a library through the group registration section, it can be henceforth dealt with like action as components which constitute behavior, and it is displayed as a box on an edit display.

[0189] Behavior can include the conditional judgment for branching in the branching list to two or more actions of consecutiveness besides mere connection of actions, or can form the loop formation of action.
[0190] When connecting action, the terminal for connection is formed in a connection side list to each action a connected side. Formation of a terminal is performed by the terminal setting-out section. By starting the terminal setting-out section, on an edit display, a terminal setting-out window is shown a pop-up table, and the detail of a terminal can be specified. Moreover, on a behavior edit display, actions which correspond by dragging the terminals of a box can be connected.
[0191] When a certain action sets up branching to two or more actions, the branching setting-out section is called. On an edit display, a branching setting-out window is shown a pop-up table by starting of the branching setting-out section, and the detail of branching can be specified.
[0192] The conditioning section is called when setting up conditions for a certain action to progress to consecutive action. On an edit display, a conditioning window is shown a pop-up table by starting of the conditioning section, and the detail of conditional judgment can be specified.
[0193] A behavior edit window is presented on a computer screen by the user interface control section. On this behavior edit window, the program which realizes a certain predetermined function as a whole can be constructed by connecting the box which expresses fundamentally action which is the component of behavior using the branching terminal. Two or more actions in which connection relation was formed are registered as a group, and the box showing a group can be components-ized like an action box, and can be dealt with on a behavior edit window. The format of a flow chart editor is used for a behavior edit window by the appearance top.
[0194] The configuration of a behavior edit window is roughly shown in drawing 20 .
[0195] A behavior edit window consists of a title bar, a menu bar, a tool bar, and an edit field that can connect action and a group with a branching terminal and can edit a program in a flow chart edit format as a graphic display.
[0196] Each menu a "file", "edit", an "object", a "tool", a "display scale factor", and "a help" is prepared for the menu bar.
[0197] If a menu "a file" is chosen, the pull down menu which becomes "new behavior", "behavior being opened", "behavior preservation", "behavior new preservation", and a list from each sub menu of "closing" will appear further (refer to drawing 21).
[0198] Selection of a sub menu "new behavior" generates new behavior. When non-saved action is already opened, the dialog (not shown) which carries out the prompt of the check of whether to save the behavior to a user appears.
[0199] Selection of a sub menu "behavior is opened" opens the existing behavior file. When non-saved behavior is already opened, the dialog which carries out the prompt of the check of whether to save the behavior to a user appears (same as the above).
[0200] Selection of a sub menu "behavior preservation" overwrites the corresponding behavior file. In the case of a non-permanent file, like behavior new preservation (after-mentioned), a file setting-out dialog appears and the prompt of the input of a file name is carried out to a user.
[0201] If a sub menu "behavior new preservation" is chosen, a file setting-out dialog (not shown) will appear and the prompt of the input of a file name will be carried out to a

user.
[0202] Selection of a sub menu "it closes" closes the behavior edit window under starting. When the behavior file in this window has not been saved, a dialog appears and the prompt of the check of whether to save this is carried out to a user (same as the above).
[0203] Moreover, if a menu "edit" is chosen, the pull down menu which becomes "it returns", "cutoff", "copy", "overwrite attachment", "insertion attachment", and a list from each sub menu "deletion" will appear further (refer to drawing 22).
[0204] Selection of a sub menu "it returns" performs undo processing sequentially from the latest actuation.
[0205] Selection of a sub menu "cutoff" cuts the selected object. The cut data are actually kept temporarily in a clipboard.
[0206] Selection of a sub menu "a copy" copies the selected object. The copied data are actually kept temporarily in a clipboard.
[0207] Selection of a sub menu "overwrite attachment" pastes the object currently kept in the clipboard on a behavior edit field.
[0208] Selection of a sub menu "deletion" deletes the selected object.
[0209] A menu "an object" places the object used as the components for program editors on a behavior edit field, or offers the function for performing actuation to the installed object. The components for program editors are the terminals (branching terminal) for connecting between box-ized action, a branch, a group, or these boxes. These objects serve as a component of a flow chart.
[0210] If a menu "an object" is chosen, the pull down menu which becomes "action is placed", "a new branch being placed", "a new group being placed", "a new terminal being placed", and a list from each sub menu a "property" will appear further (refer to drawing 23).
[0211] If a sub menu "action is placed" is chosen, a file selection dialog (not shown) will appear and the prompt of the selection of an action file will be carried out to a user. Selected action is placed on a behavior edit field as an object, i.e., an "action box." The action is simultaneously registered into a project window (above-mentioned) automatically.
[0212] If a sub menu "a new branch is placed" is chosen, a new branch will be generated and it will place on a behavior edit field, the object, i.e., a "branch box", corresponding to this. A default identifier is attached to a new branch and a user can change this into a suitable identifier.
[0213] If a sub menu "a new group is placed" is chosen, a new group will be generated and it will place on a behavior edit field, the object, i.e., a "group box", corresponding to this. A default identifier is attached to a new group and a user can change this into a suitable identifier.
[0214] If a sub menu "a new terminal is placed" is chosen, a new terminal will be generated and this will be placed on a behavior edit field. A default identifier is attached to a new terminal and a user can change this into a suitable identifier.
[0215] If a sub menu "a property" is chosen, the property dialog of the object chosen will appear. A user can set up the property of the object which corresponds within this dialog. However, about a property dialog, it mentions later.
[0216] In addition, the same function as each sub menu item of an object menu is offered

also on a tool bar (after-mentioned).
[0217] A menu "a tool" prepares sub menus, such as the "Arrow tool", a "connection tool", and a "line end tool." Preparation of each sub menu calls the corresponding function. The same function as these sub menus is arranged as a tool box on a tool bar (after-mentioned).
[0218] Moreover, a menu "a display scale factor" is a menu item for choosing the display scale factor of a behavior edit field. In this example, 1/4, 1/2, etc. are preparing twice, twice, 4 times, and 8 times as alternative.
[0219] Moreover, sub menus, such as a topic, and a support web, version information, are contained in the menu "a help" (common knowledge).
[0220] In the tool bar, the object box for calling, the components, i.e., the object, which should put the function used frequently [the "Arrow tool", a "connection tool", a "line end tool" a "magnifier", a "garbage can", etc.] on behavior edit fields, such as a tool box for calling in an instant, "action" and a "group", a "branch", and a "terminal", is arranged.
[0221] If a tool box "the Arrow tool" is specified, the mouse actuation in a behavior edit field will become the normal mode, i.e., the mode to which an object is moved.
[0222] If a tool box "a connection tool" is specified, the mouse actuation in a behavior edit field will become connection mode, i.e., the mode which connects objects.
[0223] If a tool box "a line end tool" is specified, the mouse actuation within a behavior edit field will become line end mode, i.e., the mode in which the connection between objects is cut.
[0224] Assignment of a tool box "a magnifier" carries out the single step [every] enlarged display of the event of a mouse being clicked. Moreover, if a magnifier is clicked pushing a Control key, a single step [every] reduced display will be carried out. The display scale-factor range follows the sub menu item (above-mentioned) prepared within a menu "a display scale factor."
[0225] If a tool box "a garbage can" is specified, the object by which the mouse was clicked can be deleted from a behavior edit field.
[0226] Each tool box "the Arrow tool", a "connection tool", a "line end tool", and a "magnifier" are chosen exclusively.
[0227] By dragging a box "action" in a behavior edit field from a tool bar, a new action box is put on a drag place. The property dialog for being able to come, simultaneously setting up the detail of this new action appears on a screen.
[0228] In drawing 24 , the property dialog for specifying the detail of an action box is illustrated. It is called by dragging the action box in a tool bar to a behavior edit field, and also the property dialog for this action setting out can be started via the sub menu item "a property" of a menu "an object."
[0229] A user can specify the identifier of an action box by inputting a character string into the identifier field on the dialog of a graphic display. Moreover, the comment about this action box can be filled in on a comment field.
[0230] Whether the direct input of the command name and command parameter of RCODE is carried out into combo boxes, such as Action, Part, Sound, and Volume#, furthermore, or the right end of this box By choosing a desired command or a desired command parameter from the list box (not shown) which pushes a carbon button and appears, one line, i.e., the RCODE command for one step, can be set up.
[0231] If the RCODE command for one step is set up using combo boxes, such as these

Action(s), Part, Sound, and Volume#, and a carbon button [additional (A)] is clicked further, sequential registration will be carried out on a command list.
[0232] Moreover, it is on this command list, and after choosing a predetermined line, by clicking [modification (M)] carbon button, the line concerned serves as an object for modification, and that content of setting out is displayed on each combo box, such as Action, Part, Sound, and Volume#. Moreover, it is on this command list, and after choosing a predetermined line, the line concerned can be deleted from a command list by clicking [deletion (D)] carbon button.
[0233] And if assignment of the detail of a box of operation is completed on this dialog, while the content of assignment which minded the screen by clicking the closed [(C]) carbon button will be registered as a manipulation routine described by RCODE, this dialog closes.
[0234] Moreover, a new branch box is put on a drag place by dragging a box "a branch" in a behavior edit field from a tool bar. The property dialog for being able to come, simultaneously setting up the detail of this new branch appears on a screen.
[0235] In drawing 25 , the property dialog for specifying the detail of a branch box is illustrated. It is called by dragging the branch box in a tool bar to a behavior edit field, and also the property dialog for this branch setting out can be started via the sub menu item "a property" of a menu "an object."
[0236] A user can specify the identifier of a branch box by inputting a character string into the identifier field on the dialog of a graphic display. In the example of a graphic display, "mode branching" is filled in as an identifier of the branching box concerned. Moreover, the comment about this branch box can be filled in on a comment field.
[0237] Whether the direct input of the command name and command parameter of RCODE is carried out into combo boxes, such as Type and Variable, furthermore, or the right end of this box By choosing a desired command or a desired command parameter from the list box (not shown) which pushes a carbon button and appears, the RCODE command which describes the conditional judgment of the branching box concerned can be set up.
[0238] If the RCODE command of branch condition is set up using combo boxes, such as these Type(s) and Variable, and a carbon button [additional (A)] is clicked further, sequential registration will be carried out on a command list.
[0239] Moreover, it is on this command list, and after choosing a predetermined line, by clicking [modification (M)] carbon button, the line concerned serves as an object for modification, and that content of setting out is displayed on each combo box, such as Type and Variable. Moreover, it is on this command list, and after choosing a predetermined line, the line concerned can be deleted from a command list by clicking [deletion (D)] carbon button.
[0240] And if assignment of the detail of a branch box is completed on this dialog, while the content of assignment will be registered by clicking the closed [(C]) carbon button as a manipulation routine described by RCODE, a dialog closes.
[0241] By using a branch box, processing can be branched according to a sensor input or a user variable value.
[0242] Moreover, a new group box is put on a drag place by dragging a box "a group" in a behavior edit field from a tool bar. The property dialog for being able to come, simultaneously setting up this new group's detail appears on a screen.

[0243] In drawing 26 , the property dialog for specifying the detail of a group box is illustrated. It is called by dragging the action box in a tool bar to a behavior edit field, and also the property dialog for these group setting can be started via the sub menu item "a property" of a menu "an object."
[0244] On the dialog shown in this drawing, a group name and the identifier given to a group box in a behavior edit field (displayed) can be set up.
[0245] Moreover, a new terminal box is put on a drag place by dragging a box "a terminal" in a behavior edit field from a tool bar. The property dialog for being able to come, simultaneously setting up the detail of this new terminal appears on a screen.
[0246] In drawing 27 , the property dialog for specifying the detail of a terminal box is illustrated. It is called by dragging the terminal box in a tool bar to a behavior edit field, and also the property dialog for this terminal setting out can be started via the sub menu item "a property" of a menu "an object." The identifier given to a terminal (displayed) can be set up on the dialog shown in this drawing.
[0247] By clicking the connection tool in a tool bar, it is as having already stated that between each box in a behavior edit field is connectable. In case between boxes is connected, the conditions for judging authorization/disapproval of connection can be set up. What is necessary is just to call the dialog for setting up conditions (Condition) to set up decision conditions.
[0248] In drawing 28 , the property dialog for specifying the detail of connection conditions is illustrated. The property dialog for these conditioning can be started via the sub menu item "a property" of a menu "an object." Within this dialog, the combination of two or more conditions (the example of a graphic display a maximum of four conditions) of having used the AND (AND), the OR (OR), etc. can be set up as connection conditions.
[0249] Subsequently, program editor processing in a behavior edit field is explained.
[0250] In this edit field, drag-and-drop actuation of each object is permitted. Each object, such as action, and a group, a branch, is components-ized in the format of a "box", and a user can construct the program which is described by the connection relation of a box and which realizes a certain function as a whole through the activity which repeats the connection and cutting between boxes by drag-and-drop actuation between each boxes. The format of a flow chart editor is used for an editing task by the appearance top.
[0251] On a new behavior edit window as shown in drawing 20 , terminal "START" which shows a program and initiation of a routine, and terminal "RETURN" which shows a program and termination of a routine to a list can be placed by drag-and-drop actuation of a terminal box (drawing 29).
[0252] Dropping a terminal box on a behavior edit field can be interlocked with, a property dialog as shown in drawing 27 can start, and the detail of a terminal can be set up.
[0253] RETURN meant the output terminal of a program or a routine and one program and routine may be equipped with two or more output terminals as the graphic display.
[0254] A branch box can be placed on a behavior edit field at an action box list by drags and drops an action box and a branch box from a tool bar to a behavior edit field. Under the present circumstances, the property dialog (refer to drawing 24 and drawing 25) for setting up the detail of action or a branch is shown a pop-up table. The identifier of action assigned to an action box can be specified on each property dialog, a group's identifier

assigned to a group box can be specified, or an identifier can be given to a new branch box. Signs that the action box and the group box branch box have been arranged on a behavior edit field are shown in drawing 30 .

[0255] As shown in drawing 30 , each box consists of a box body with which the box name was displayed, the input terminal section of the box which adjoins the upper bed of this box body, and the output terminal section which adjoins the soffit of a box body.

[0256] Furthermore, a behavior edit field serves as connection mode by clicking the connection tool in a tool bar. Under this mode of operation, the connection relation between boxes can be formed by carrying out drag actuation of between the output terminal section of a certain box, and the input terminal sections of other boxes.

[0257] In case between boxes is connected, the conditions for judging authorization/disapproval of connection can be set up. What is necessary is just to call the dialog (to refer to drawing 28) for setting up conditions (Condition) to set up decision conditions.

[0258] Signs that connection relation was formed between each box, such as an action box arranged on a behavior edit field and a group box branch box, are shown in drawing 31 .

[0259] It means that the routine which constitutes a part of program which realizes a certain predetermined function, or program was constructed on the behavior edit field by setting the connection relation between each box as the arrangement list of the box to be used. On a behavior edit field, since a program and a routine are displayed in a format similar to a flow chart, a user can edit a desired program and a desired routine pessimistically easily and intuitively in the format of editing a flow chart.

[0260] By registering as a group the routine constructed in the shape of a flow chart on the behavior edit field, it becomes possible to treat this as components, i.e., an object, like action, the existing group, etc. For example, in case other programs and routines (high order) are built, the group who newly registered can be used.

[0261] For example, grouping of the program or routine formed on the behavior edit field as shown in drawing 31 can also be carried out.

[0262] Signs that the group box which carried out grouping of the program or routine formed in drawing 32 on the behavior edit field shown in drawing 31 has been arranged to the behavior edit field are shown. for example, this group -- receiving -- "Group_012" -- suppose that the group name was given. Group_012 are equipped with one input terminal and three output terminals so that drawing 31 may also show.

[0263] The program (not shown) which used Group_012 as the part, i.e., the routine, of components can be constructed by arranging other object boxes, such as action, and a group, a branch, on a behavior edit field, and connecting these boxes and Group_012 with a terminal.

[0264] Moreover, the detail of the group who once edited and registered can be opened to a behavior edit field, and an editing task can be performed further. In drawing 33 , signs that the group box shown in drawing 32 was opened are illustrated.

[0265] It has explained in detail about this invention, referring to a specific example more than [addenda]. However, it is obvious that this contractor can accomplish correction and substitution of this example in the range which does not deviate from the summary of this invention.

[0266] Although explained in detail in this example about the authoring system which

mentions as an example the pet mold robot which performs quadrapedalism which imitated the dog, and starts this invention, the summary of this invention is not limited to this. for example, a leg formula mobile robot of 2 pairs of shoes like a humanoid robot -- or please understand enough that this invention is applicable similarly also to migration mold robots other than a leg formula.

[0267] Moreover, the "multi-joint structure" indicated by the column of the [claim] of this description is not limited to a physical machinery like many articulated robots including a leg formula robot. For example, it is also possible to apply the authoring system which starts this invention for creation and edit of the operating sequence of the animation using the character generated by computer graphics.

[0268] In short, with the gestalt of instantiation, this invention has been indicated and it should not be interpreted restrictively. In order to judge the summary of this invention, the column of the claim indicated at the beginning should be taken into consideration.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is drawing having shown the appearance configuration of the mobile robot 1 which performs the leg formula walk by the limbs with which operation is presented in this invention.

[Drawing 2] It is drawing having shown typically the block diagram of the electrical and electric equipment and control system of a mobile robot 1.

[Drawing 3] It is drawing having shown the configuration of a control section 20 in the detail further.

[Drawing 4] It is drawing having shown typically the example of a hardware configuration of a host computer 100.

[Drawing 5] It is drawing having shown typically the whole authoring system configuration concerning this example.

[Drawing 6] It is drawing having shown signs that a robot's behavior was constituted by putting two or more commands, i.e., action, in order.

[Drawing 7] It is drawing having shown signs that branching based on conditions or a probability was included into behavior.

[Drawing 8] It is drawing having shown signs that box-ized, two or more commands, i.e., action, and the subroutine was defined.

[Drawing 9] It is the block diagram having shown the functional configuration of an action edit subsystem typically.
[Drawing 10] It is drawing having shown the configuration of an action edit window roughly.
[Drawing 11] It is drawing having shown the action edit window in the condition (key frame detail channel) of having opened the key frame channel.
[Drawing 12] It is drawing having shown the action edit window in the condition (motion detail channel) of having opened the motion channel.
[Drawing 13] It is drawing having shown roughly the configuration of the sound detail window for editing the sound file of a MIDI format.
[Drawing 14] It is drawing having shown roughly the configuration of the sound detail window for displaying the sound file of a WAVE format.
[Drawing 15] It is drawing having shown roughly the configuration of the LED detail window for displaying and editing the LED actuation file described in the MIDI format.
[Drawing 16] It is drawing having shown the configuration of a preview window roughly.
[Drawing 17] It is drawing having shown the configuration of a pause window roughly.
[Drawing 18] It is drawing having shown the configuration of a motion pre viewer roughly.
[Drawing 19] It is drawing having shown the functional configuration of a behavior edit subsystem typically.
[Drawing 20] It is drawing having shown the configuration of a behavior edit window roughly.
[Drawing 21] It is drawing having shown the sub menu item of the menu in a behavior edit window "a file."
[Drawing 22] It is drawing having shown the sub menu item of the menu in a behavior edit window "edit."
[Drawing 23] It is drawing having shown the sub menu item of the menu in a behavior edit window "an object."
[Drawing 24] It is drawing having shown the property dialog for specifying the detail of an action box.
[Drawing 25] It is drawing having shown the property dialog for specifying the detail of a branch box.
[Drawing 26] It is drawing having shown the property dialog for specifying the detail of a group box.
[Drawing 27] It is drawing having shown the property dialog for specifying the detail of a terminal box.
[Drawing 28] It is drawing having shown the property dialog for specifying the detail of conditional judgment.
[Drawing 29] It is drawing having shown signs that the terminal was placed on the behavior edit field.
[Drawing 30] It is drawing having shown signs that the action box and the branch box had been arranged on a behavior edit field.
[Drawing 31] It is drawing having shown signs that connection relation was formed between each box, such as an action box arranged on a behavior edit field, and a group box branch box.
[Drawing 32] It is drawing having shown signs that the group box which carried out

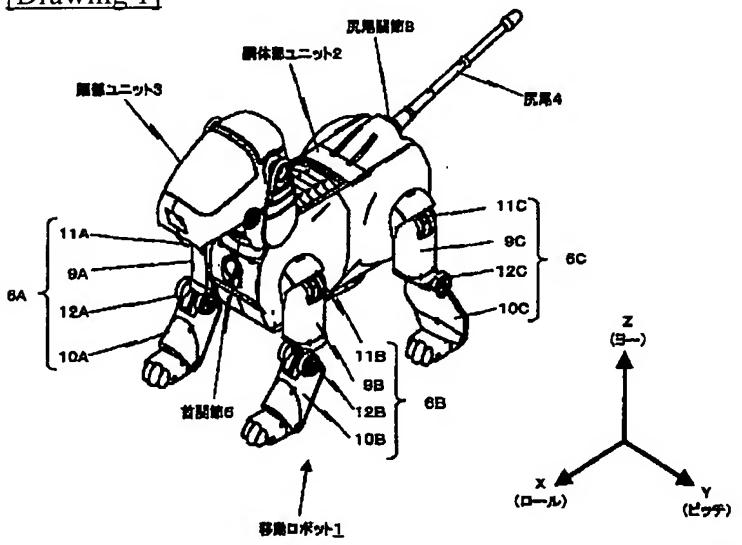
grouping of the program or routine formed on the behavior edit field shown in drawing 31 had been arranged to the behavior edit field.
[Drawing 33] It is drawing having shown signs that the group box shown in drawing 32 was opened.
[Drawing 34] It is drawing having shown the project window.
[Description of Notations]
1 -- Mobile robot
2 -- Idiosoma unit
3 -- Head unit
4 -- Tail
6A-6D -- Leg unit
7 -- Neck joint
8 -- Tail joint
9A-9D -- Femoral region unit
10A-10D -- Leg part unit
11A-11D -- Hip joint
12A-12D -- Knee joint
15 -- CCD camera
16 -- Microphone
17 -- Loudspeaker
18 -- Touch sensor
19 -- LED indicator
20 -- Control section
21 -- CPU
22 -- RAM
23 -- ROM
24 -- Nonvolatile memory
25 -- Interface
26 -- Radiocommunication interface
27 -- Network Interface Card
28 -- Bus
29 -- Keyboard
40 -- I/O section
50 -- Actuator
51 -- Motor
52 -- Encoder
53 -- Driver

[Translation done.]

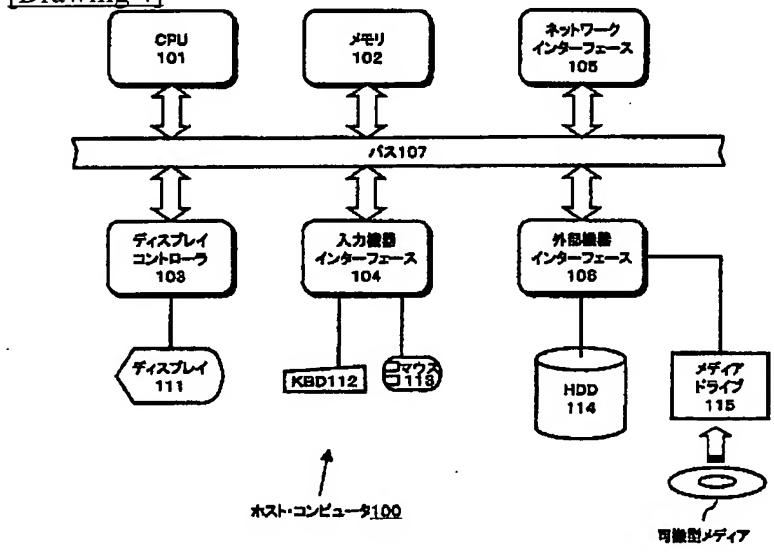
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

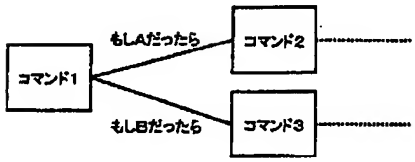
[Drawing 1]



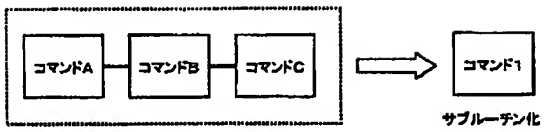
[Drawing 4]



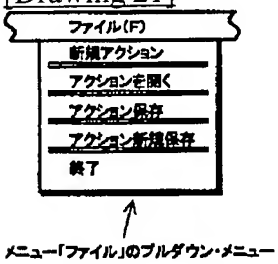
[Drawing 7]



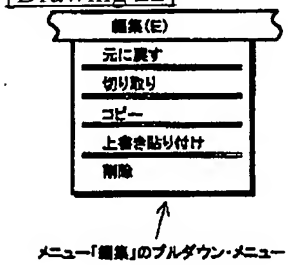
[Drawing 8]



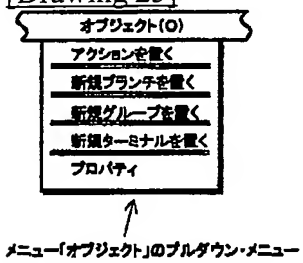
[Drawing 21]



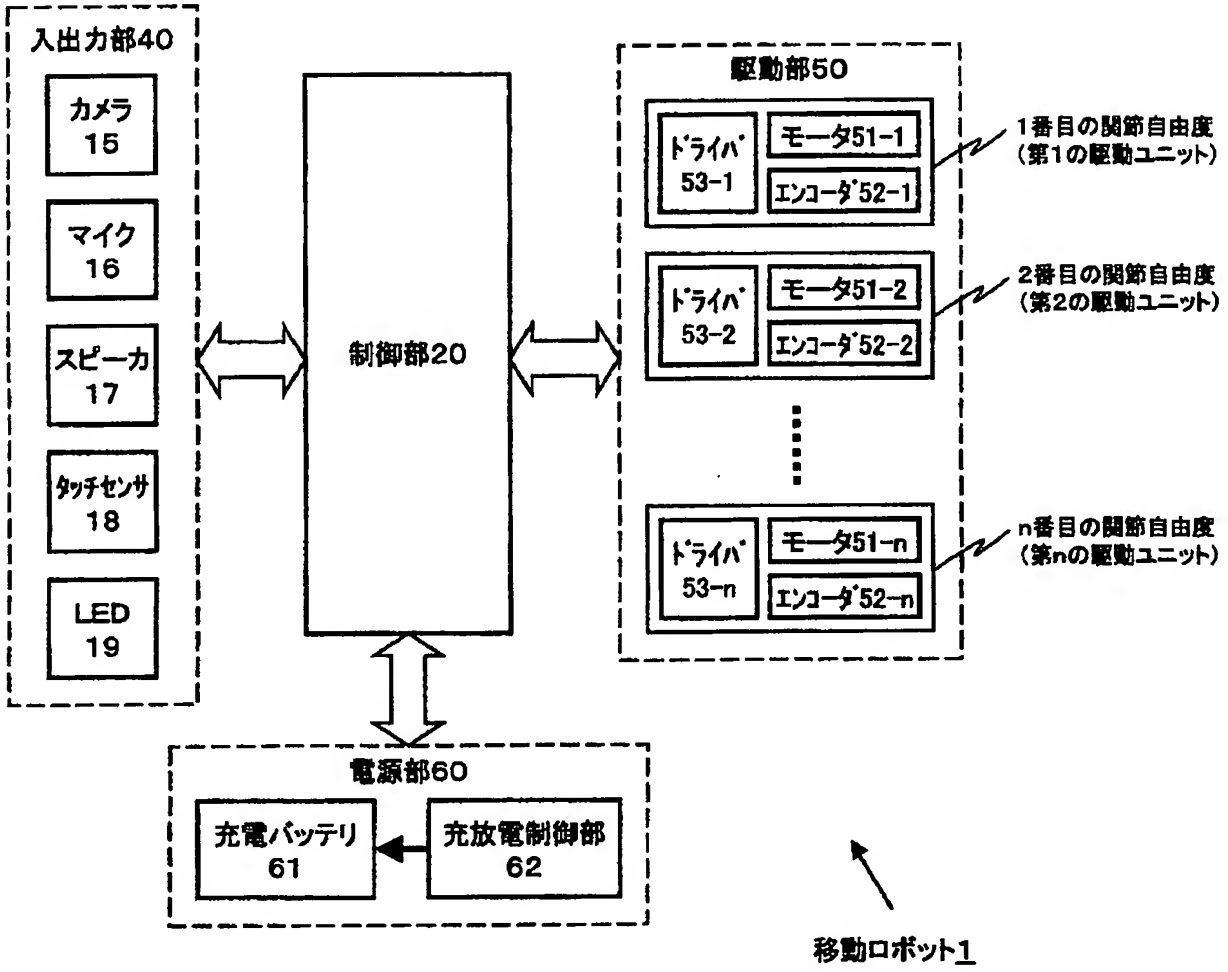
[Drawing 22]



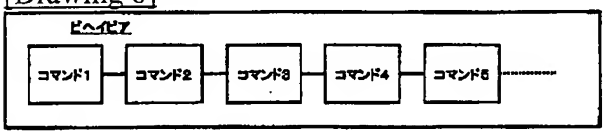
[Drawing 23]



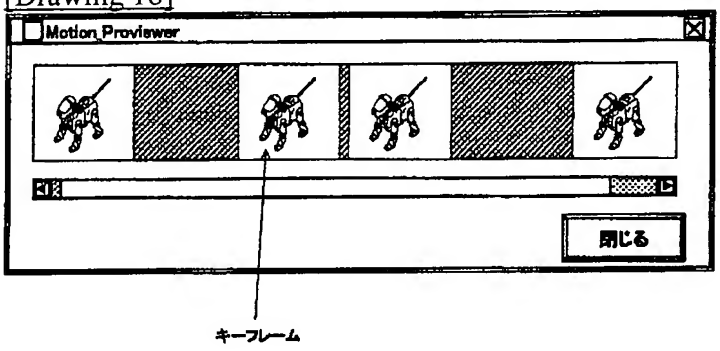
[Drawing 2]



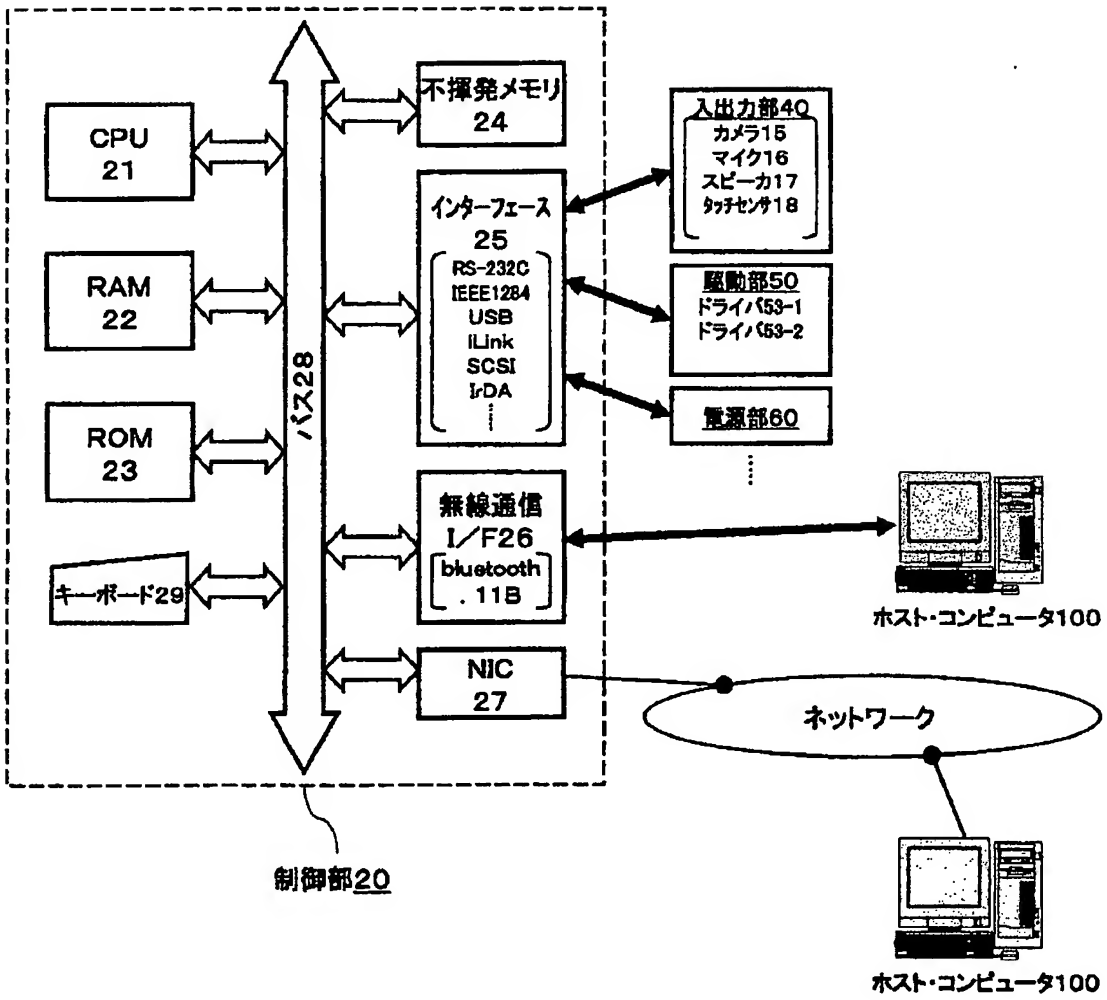
[Drawing 6]



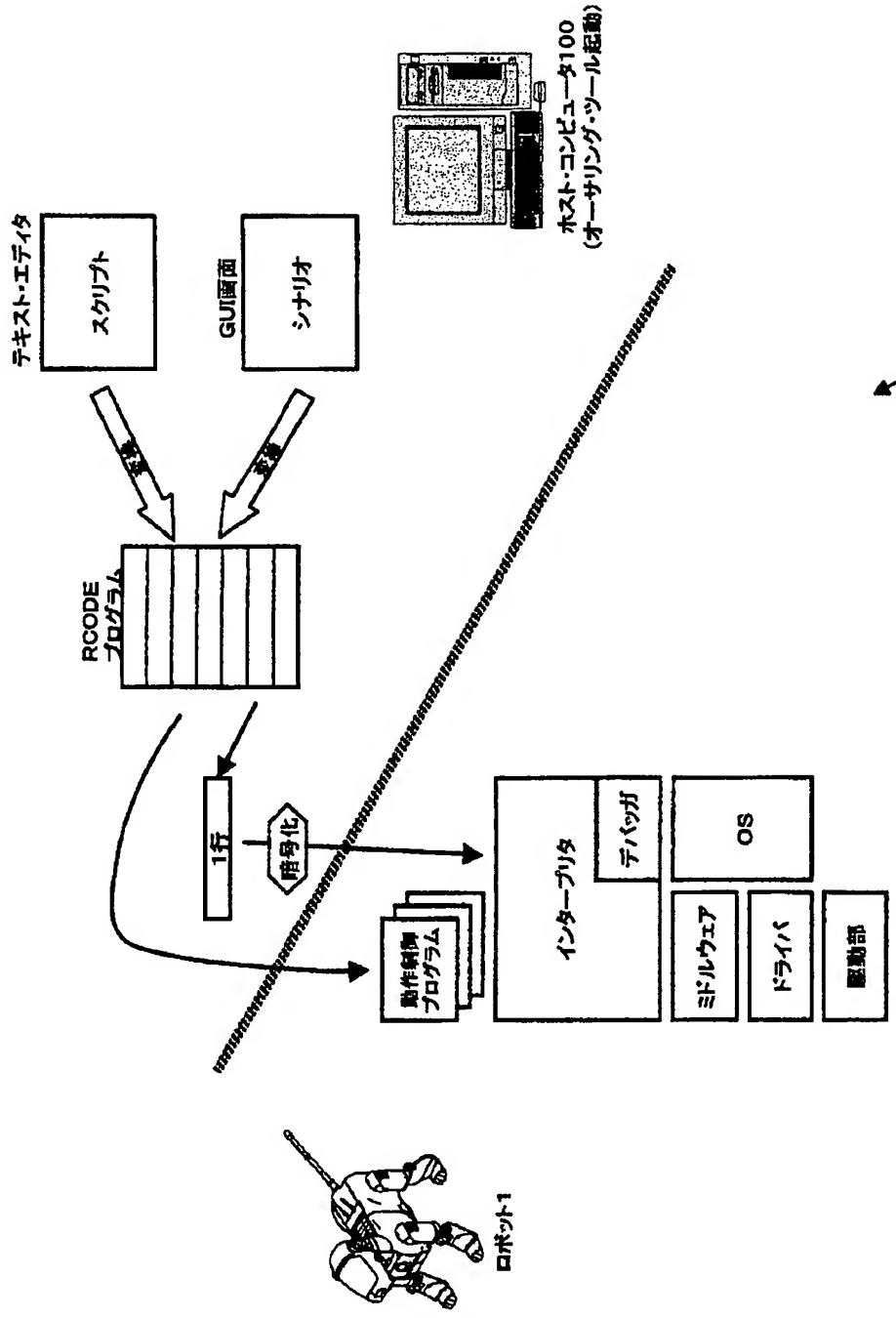
[Drawing 18]



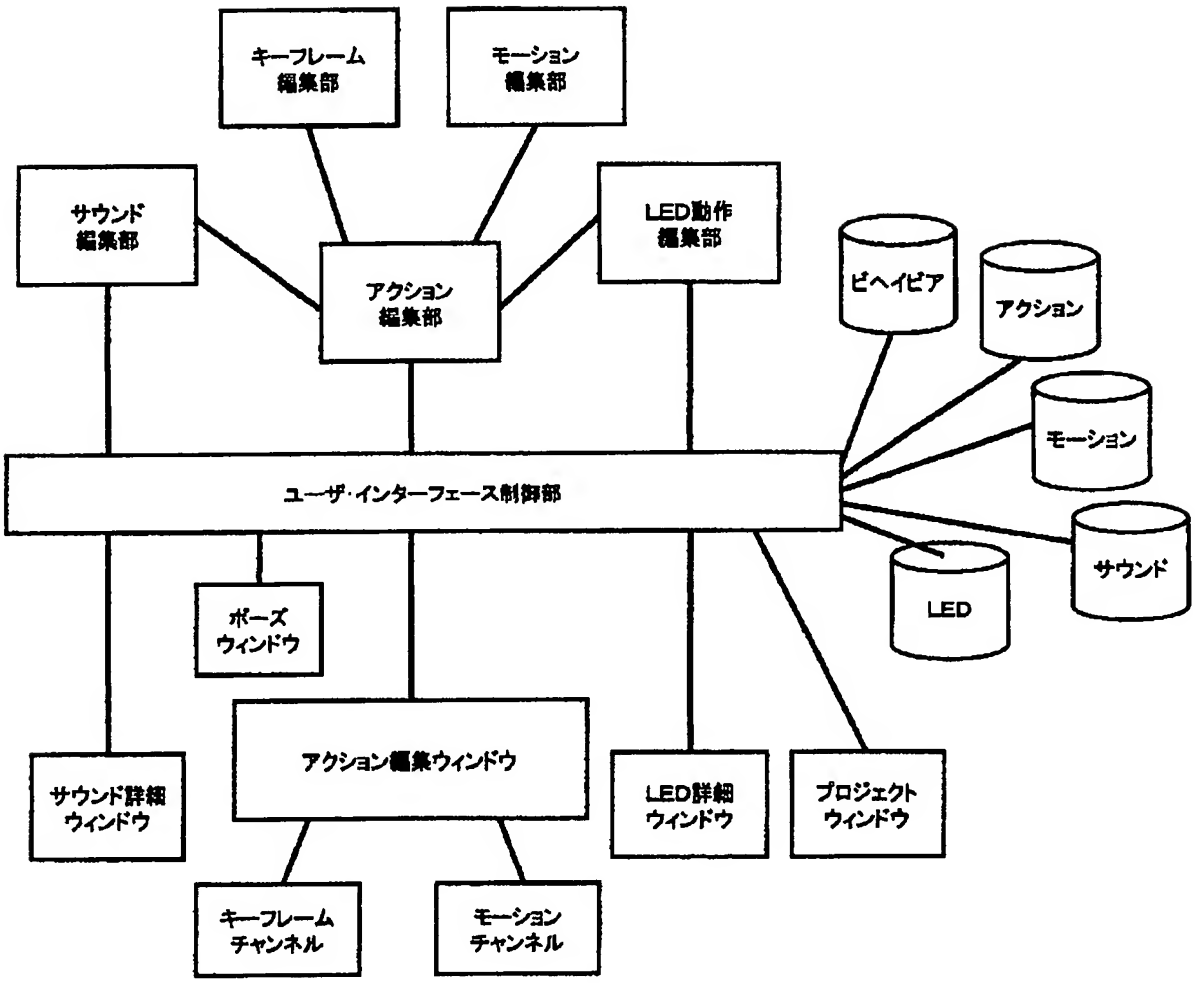
[Drawing 3]


CPU
21
RAM
22
ROM
23
キーボード29
バス28
不揮発メモリ
24
インターフェース
25
RS-232C
IEEE1284
USB
iLink
SCSI
IrDA
無線通信
I/F26
bluetooth
.11B
NIC
27
制御部20
入出力部40
カメラ15
マイク16
スピーカ17
タッチセンサ18
駆動部50
ドライバ53-1
ドライバ53-2
電源部60
ホスト・コンピュータ100
ネットワーク
ホスト・コンピュータ100

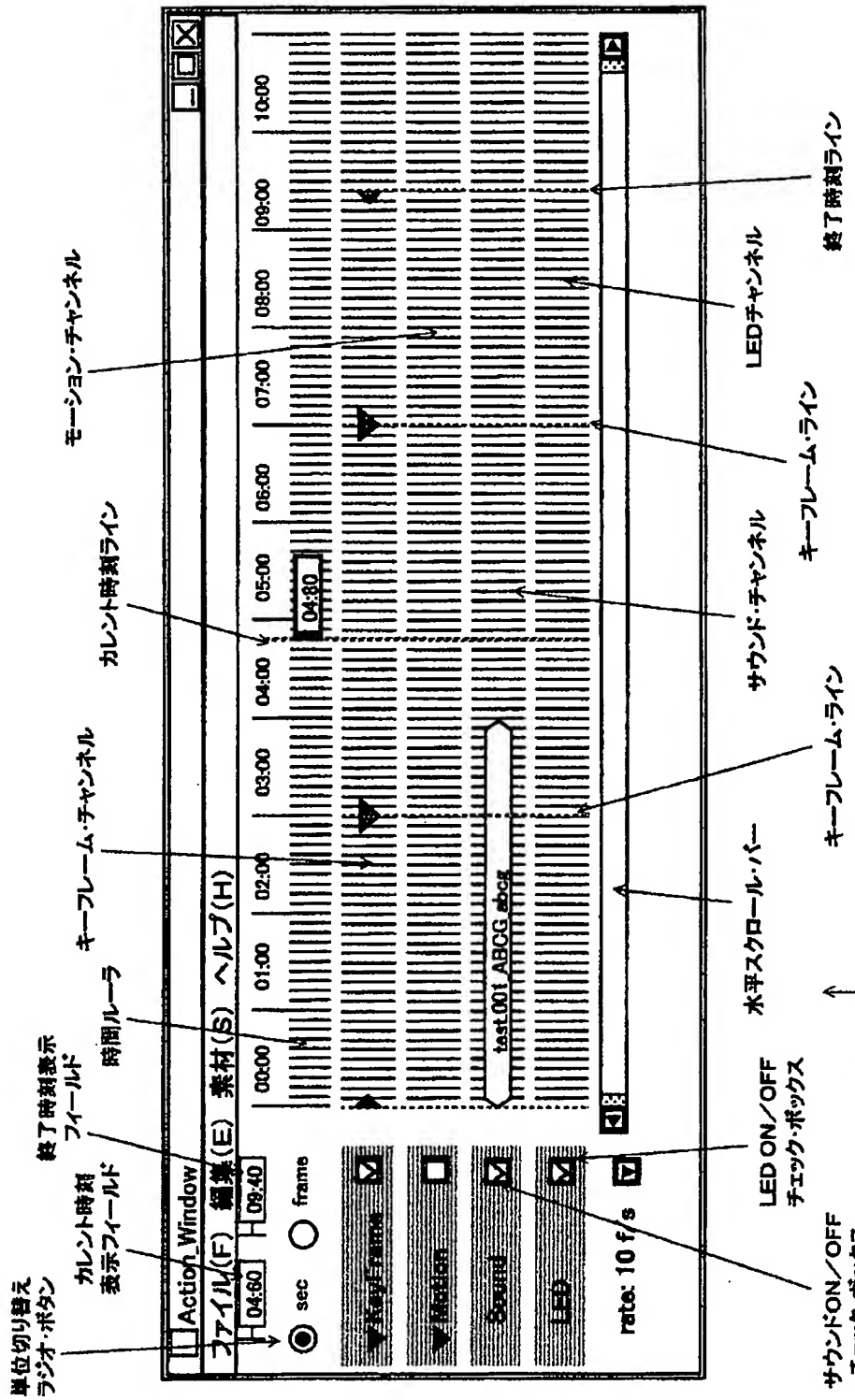
[Drawing 5]


テキスト・エディタ
スクリプト
GUI画面
シナリオ
ホスト・コンピュータ100
(オーサリング・ツール起動)
オーサリング・システム
RCODE
プログラム
1行
解釈化
動作制御
プログラム
インタープリタ
デバッガ
OS
ミドルウェア
ドライバ
駆動部
ロボット1

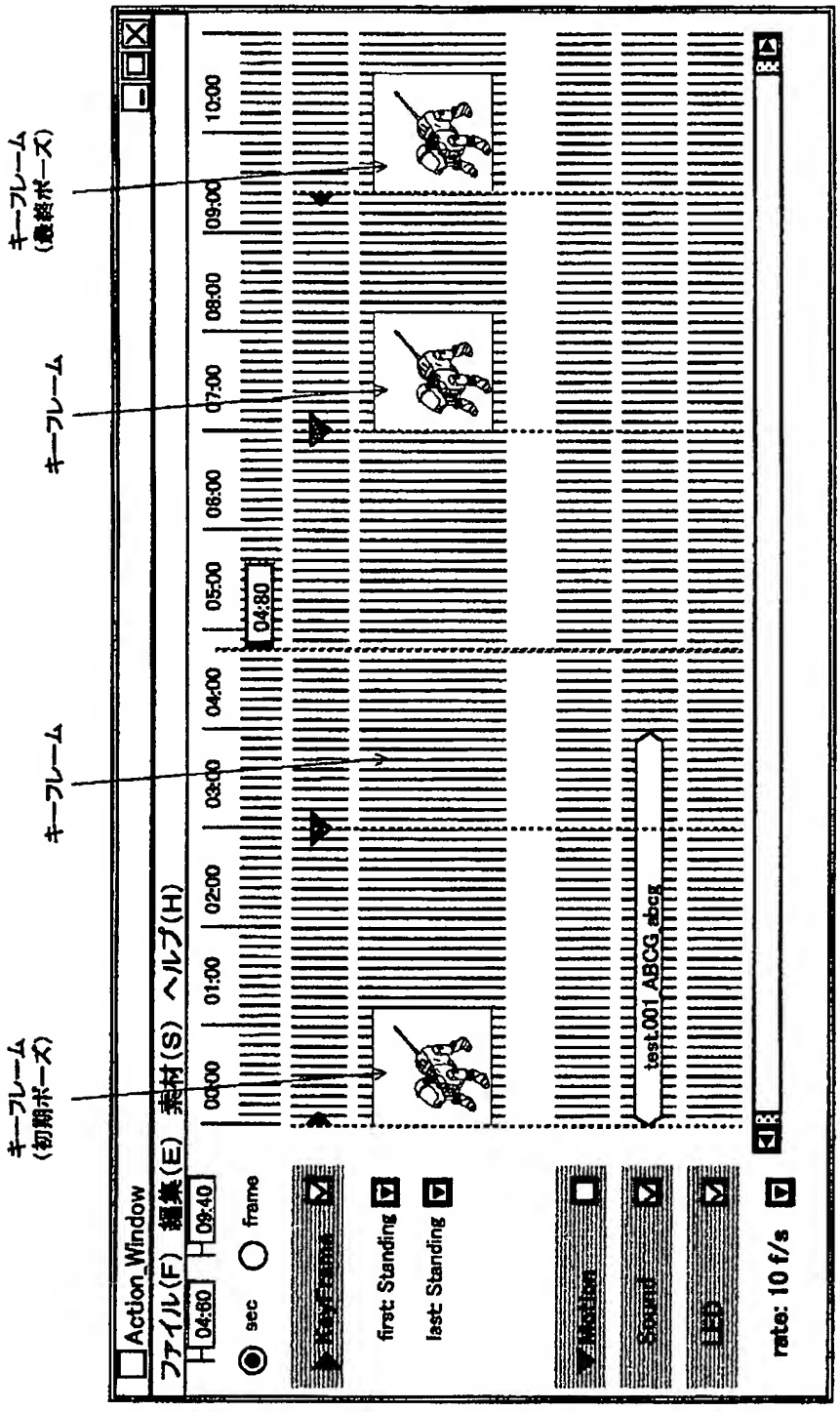
[Drawing 9]


キーフレーム
編集部
モーション
編集部
サウンド
編集部
アクション
編集部
LED動作
編集部
ビヘイビア
アクション
モーション
サウンド
LED
ユーザ・インターフェース制御部
ポーズ
ウィンドウ
アクション編集ウィンドウ
サウンド詳細
ウィンドウ
LED詳細
ウィンドウ
プロジェクト
ウィンドウ
キーフレーム
チャンネル
モーション
チャンネル

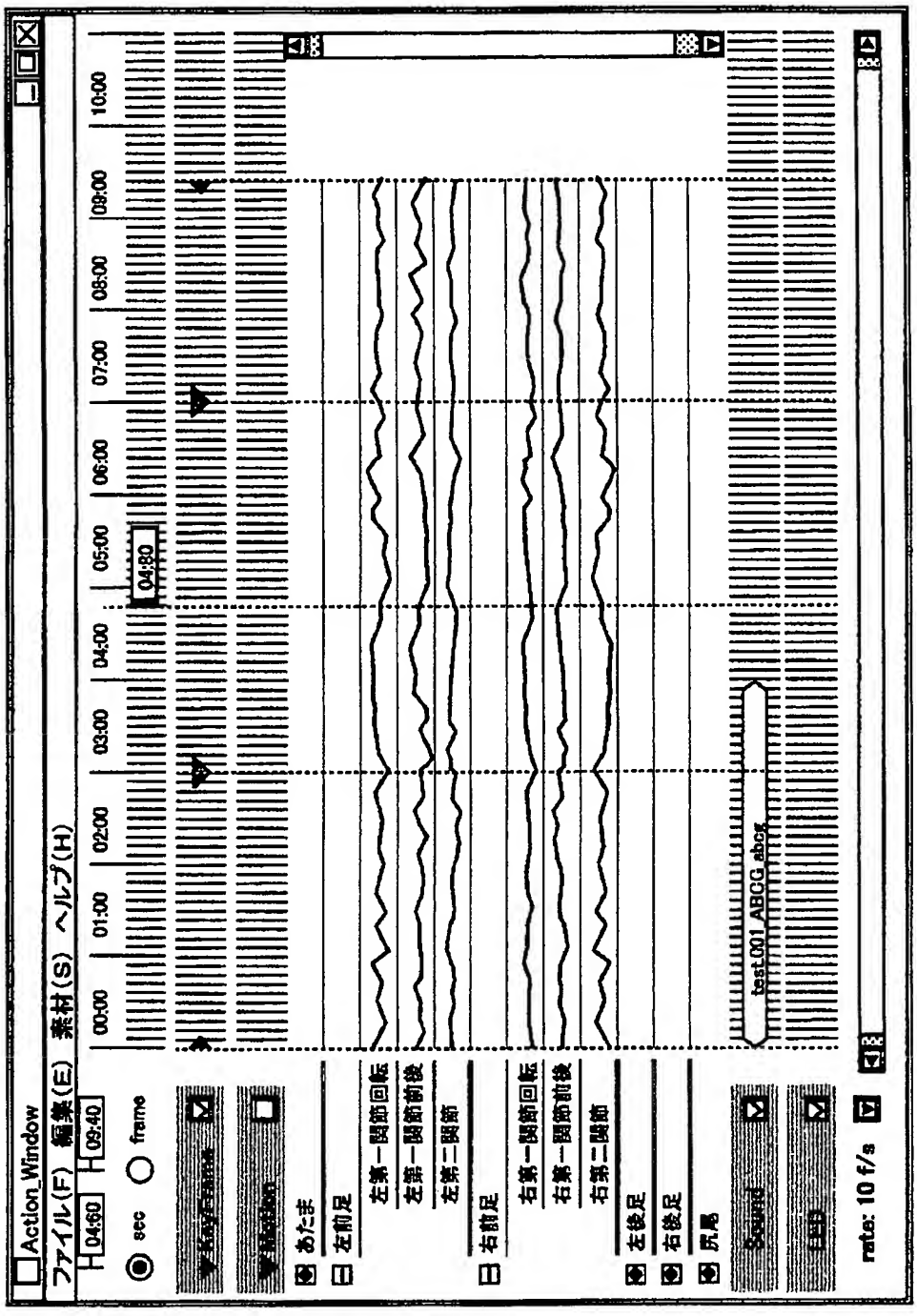
[Drawing 10]


単位切り替え
ラジオ・ボタン
カレント時刻
表示フィールド
終了時刻表示
フィールド
時間ルーラ
キーフレーム・チャンネル
カレント時刻ライン
モーション・チャンネル
Action_Window
ファイル(F) 編集(E) 素材(S) ヘルプ(H)
04:60
08:40
sec
frames
00:00
01:00
02:00
03:00
04:00
05:00
04:30
06:00
07:00
08:00
09:00
10:00
KeyFrame
Motion
Sound
LED
test.001 ABCG.abcg
rate: 10 f/s
LED ON／OFF
チェック・ボックス
水平スクロール・バー
サウンド・チャンネル
キーフレーム・ライン
LEDチャンネル
キーフレーム・ライン
終了時刻ライン
サウンドON／OFF
チェック・ボックス
アクション編集ウィンドウ

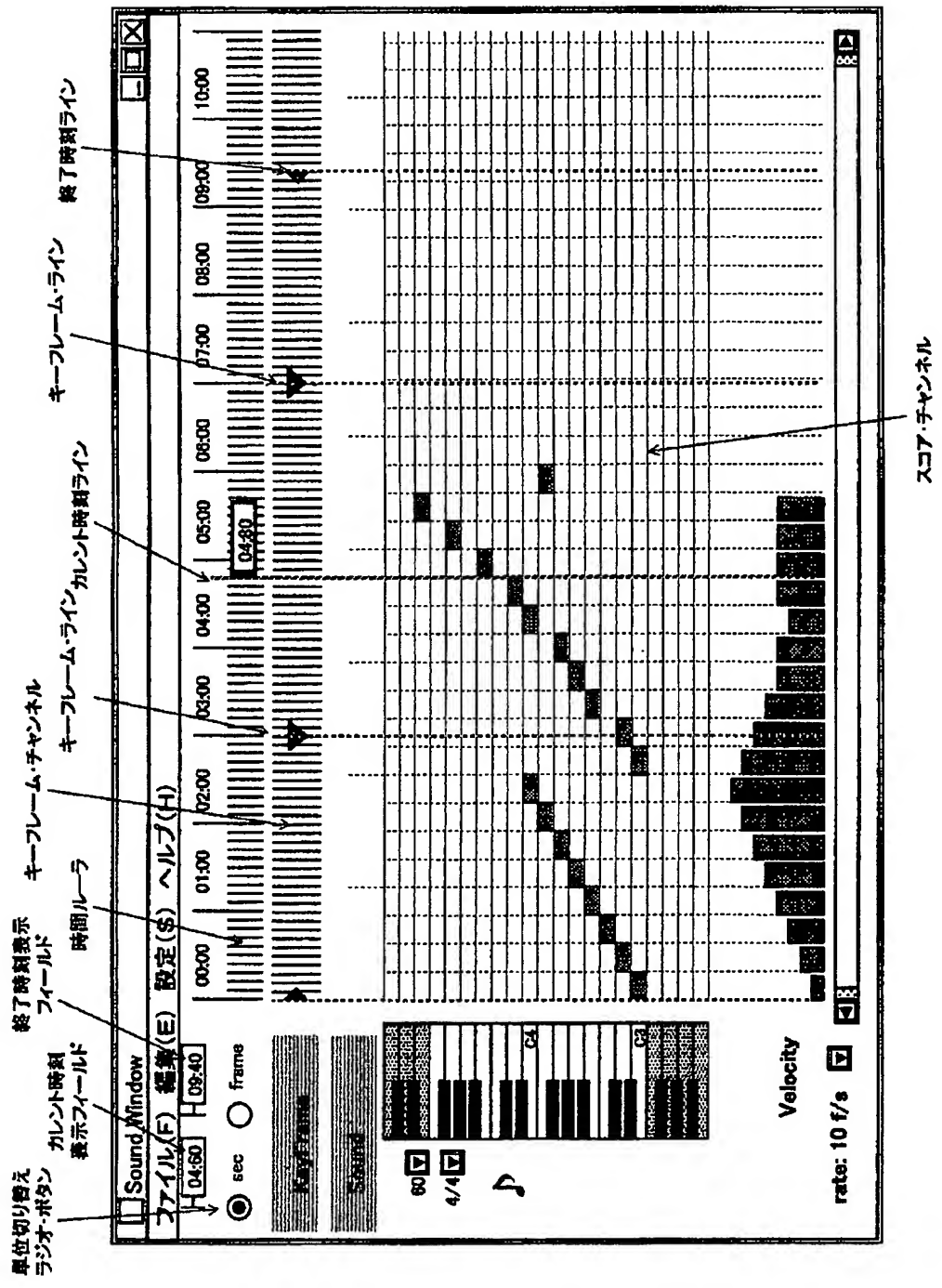
[Drawing 11]


キーフレーム
(初期ポーズ)
キーフレーム
キーフレーム
キーフレーム
(最終ポーズ)
Action Window
ファイル(F) 編集(E) 素材(S) ヘルプ(H)
04:60
09:40
sec
frame
00:00
01:00
02:00
03:00
04:00
04:80
05:00
06:00
07:00
08:00
09:00
10:00
KeyFrame
first: Standing
last: Standing
test.001 ABCG abcg
Motion
Sound
LED
rate: 10 f/s
アクション編集ウィンドウ

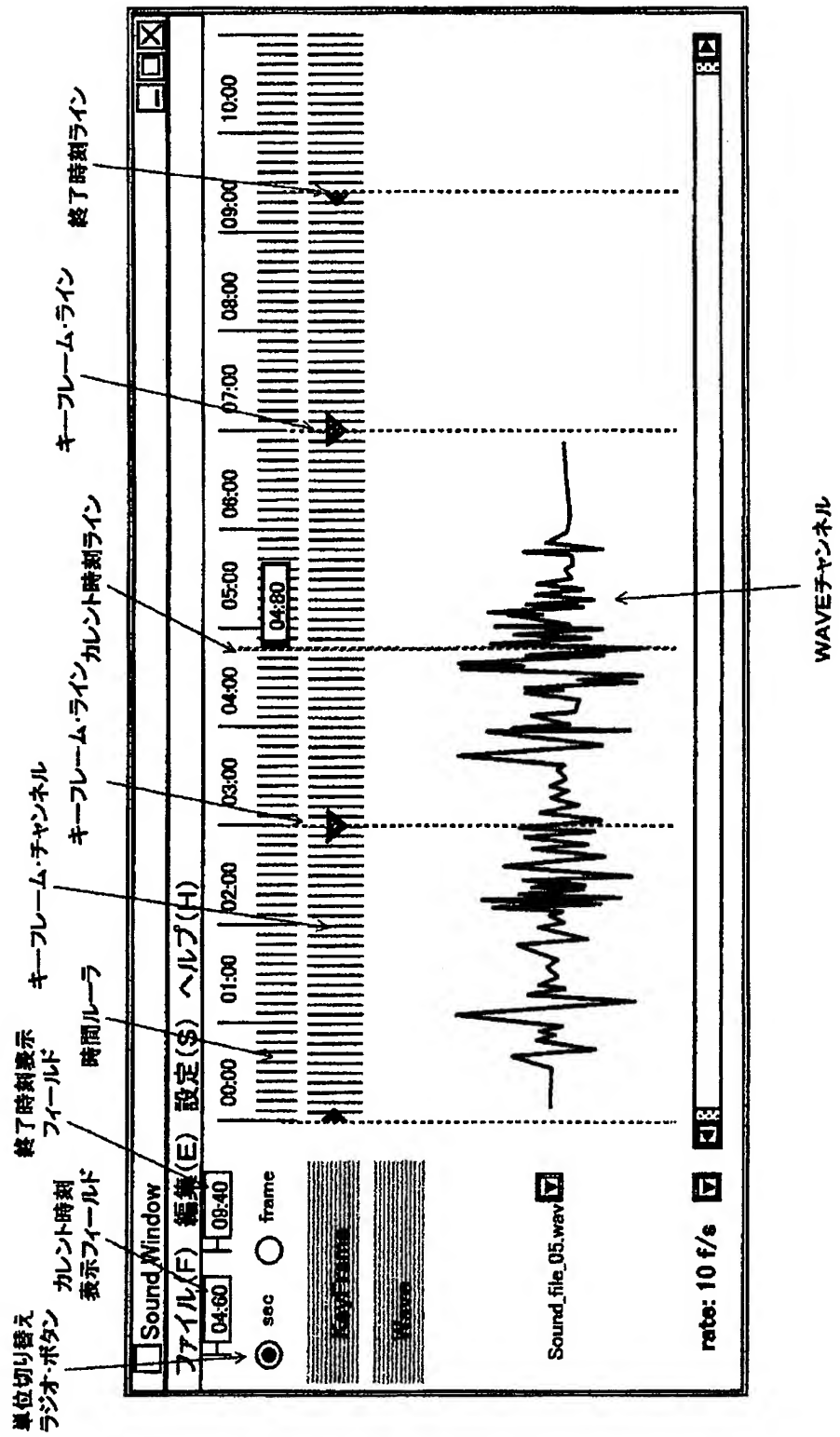
[Drawing 12]


Action_Window
ファイル(F) 編集(E) 素材(S) ヘルプ(H)
04:60
09:40
sec
frame
00:00
01:00
02:00
03:00
04:00
04:80
05:00
06:00
07:00
08:00
09:00
10:00
あたま
左前足
左第一関節回転
左第一関節前後
左第二関節
右前足
右第一関節回転
右第一関節前後
右第二関節
左後足
右後足
尻尾
test.001 ABCG.abcg
rate: 10 f/s

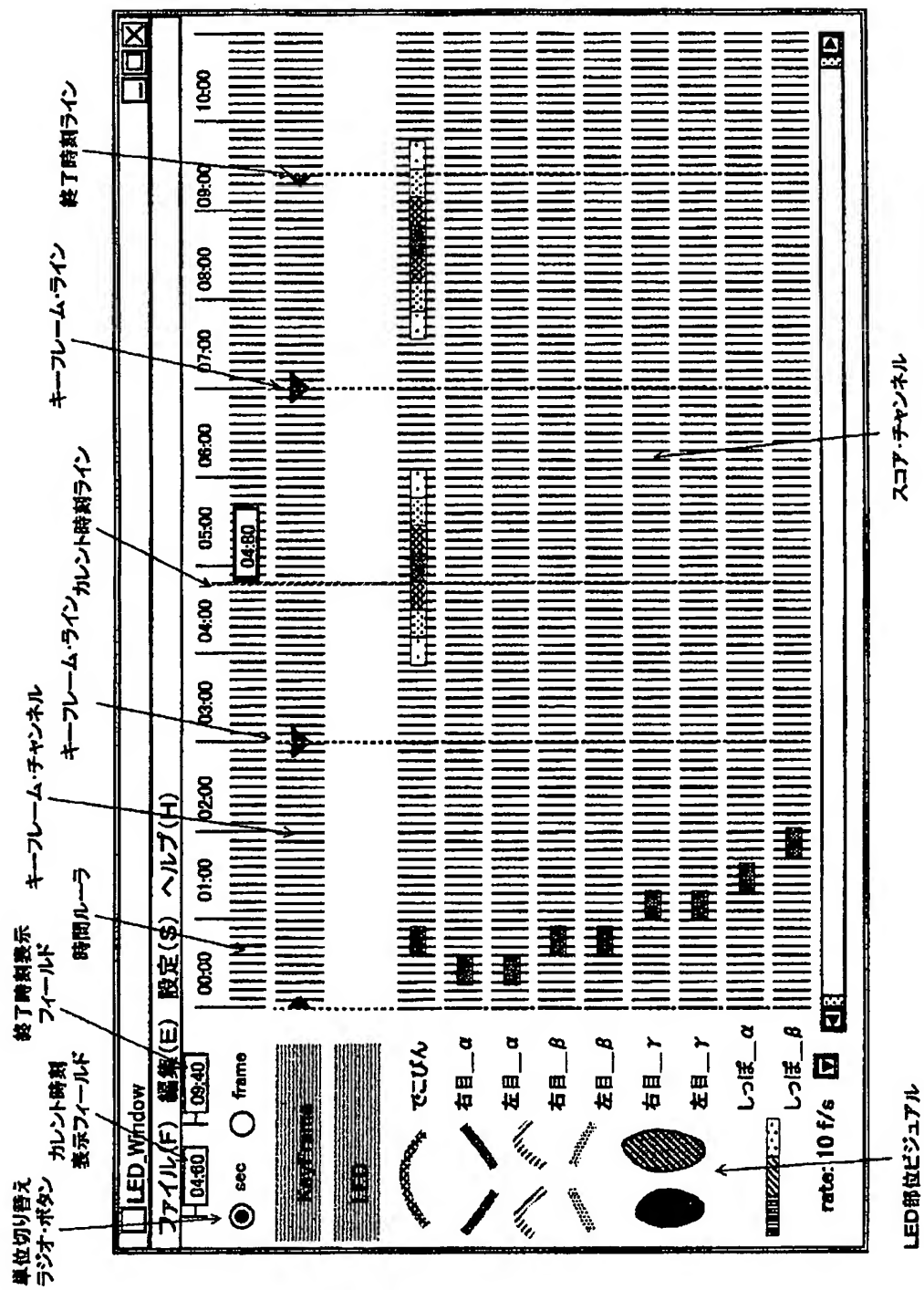
[Drawing 13]


単位切り替えラジオ・ボタン
カレント時刻表示フィールド
終了時刻表示フィールド
時間ルーラ
キーフレーム・チャンネル
キーフレーム・ライン
カレント時刻ライン
キーフレーム・ライン
終了時刻ライン
スコア・チャンネル
Sound Window
ファイル(F) 編集(E) 設定(S) ヘルプ(H)
04:60
09:40
sec
frame
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
04:30
Key Frame
Sound
C4
C3
60
4/4
Velocity
rate: 10 f/s

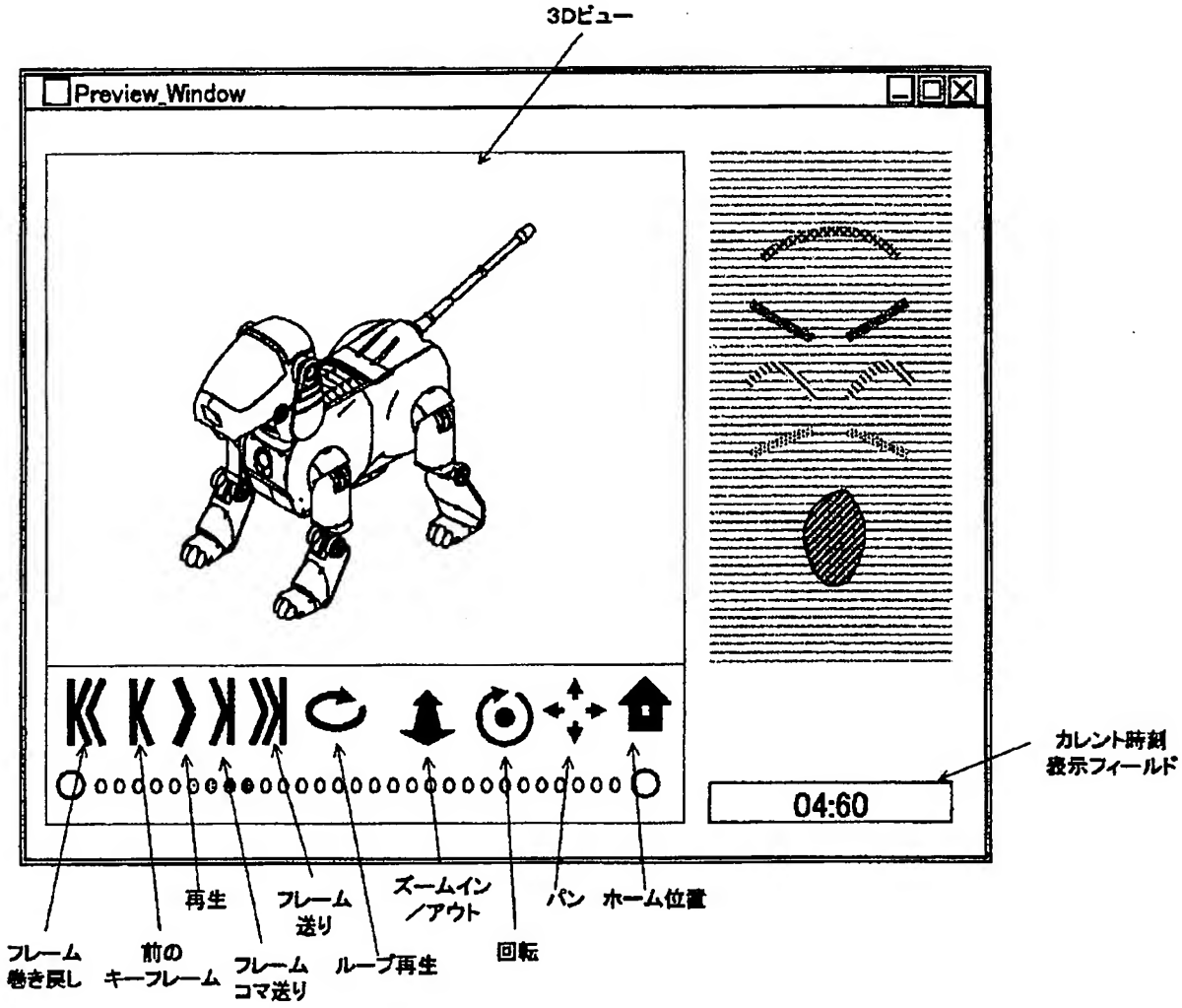
[Drawing 14]


単位切り替え
ラジオ・ボタン
カレント時刻
表示フィールド
終了時刻表示
フィールド
時間ルーラ
キーフレーム・チャンネル
キーフレーム・ライン
カレント時刻ライン
キーフレーム・ライン
終了時刻ライン
WAVEチャンネル
Sound Window
ファイル(F) 編集(E) 設定(S) ヘルプ(H)
04:60
09:40
sec
frame
00:00
01:00
02:00
03:00
04:00
05:00
04:80
06:00
07:00
08:00
09:00
10:00
Sound_file_05.wav
rate: 10 f/s

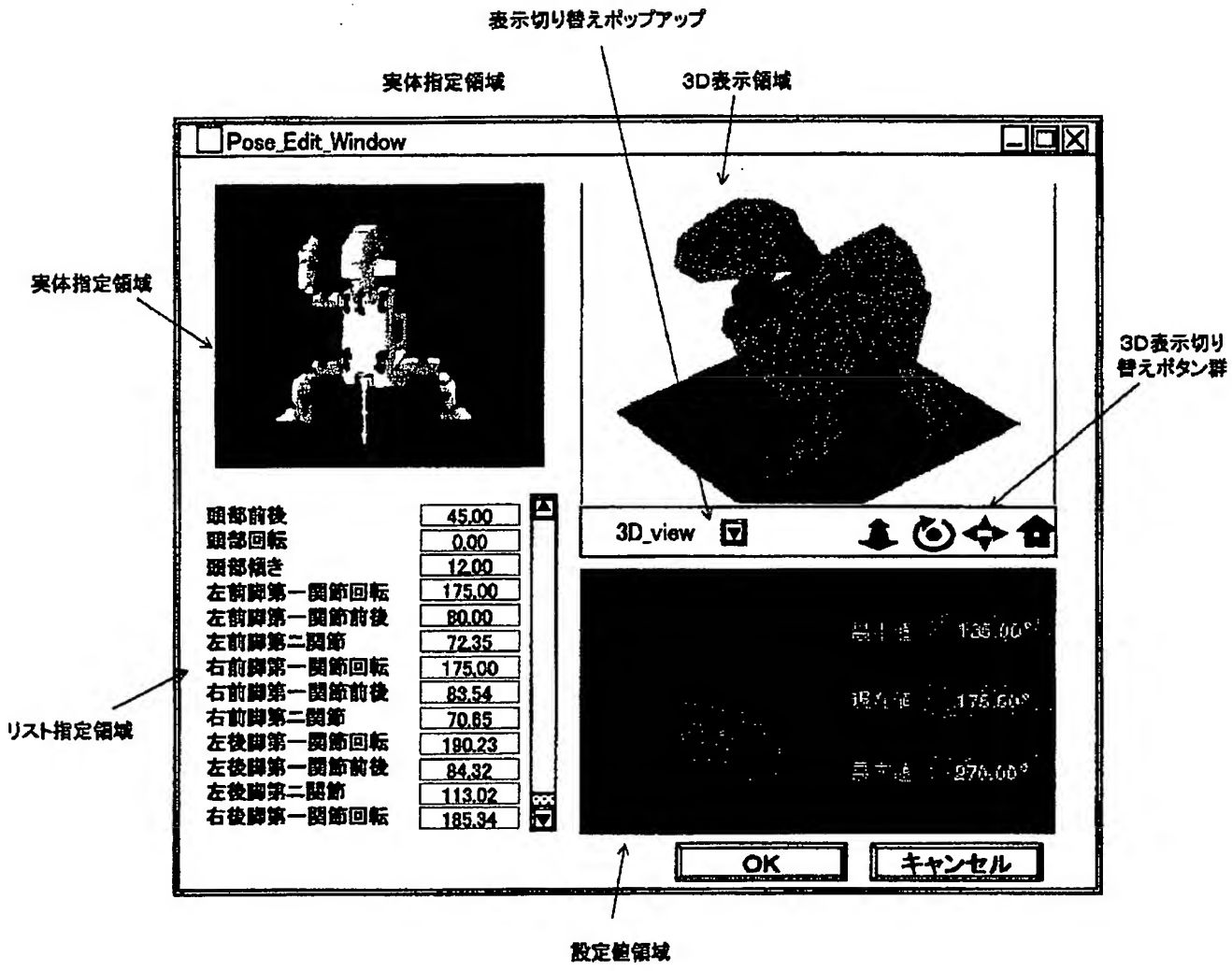
[Drawing 15]


単位切り替え
ラジオ・ボタン
カレント時刻
表示フィールド
終了時刻表示
フィールド
時間ルーラ
キーフレーム・チャンネル
キーフレーム・ライン
カレント時刻ライン
キーフレーム・ライン
終了時刻ライン
スコア・チャンネル
LED部位ビジュアル
LED_Window
ファイル(F) 編集(E) 設定(S) ヘルプ(H)
04:60
09:40
sec
frame
00:00
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
04:60
KeyFrame
LED
てにびん
右目_α
左目_α
右目_β
左目_β
右目_γ
左目_γ
しっぽ_α
しっぽ_β
rate: 10 f/s

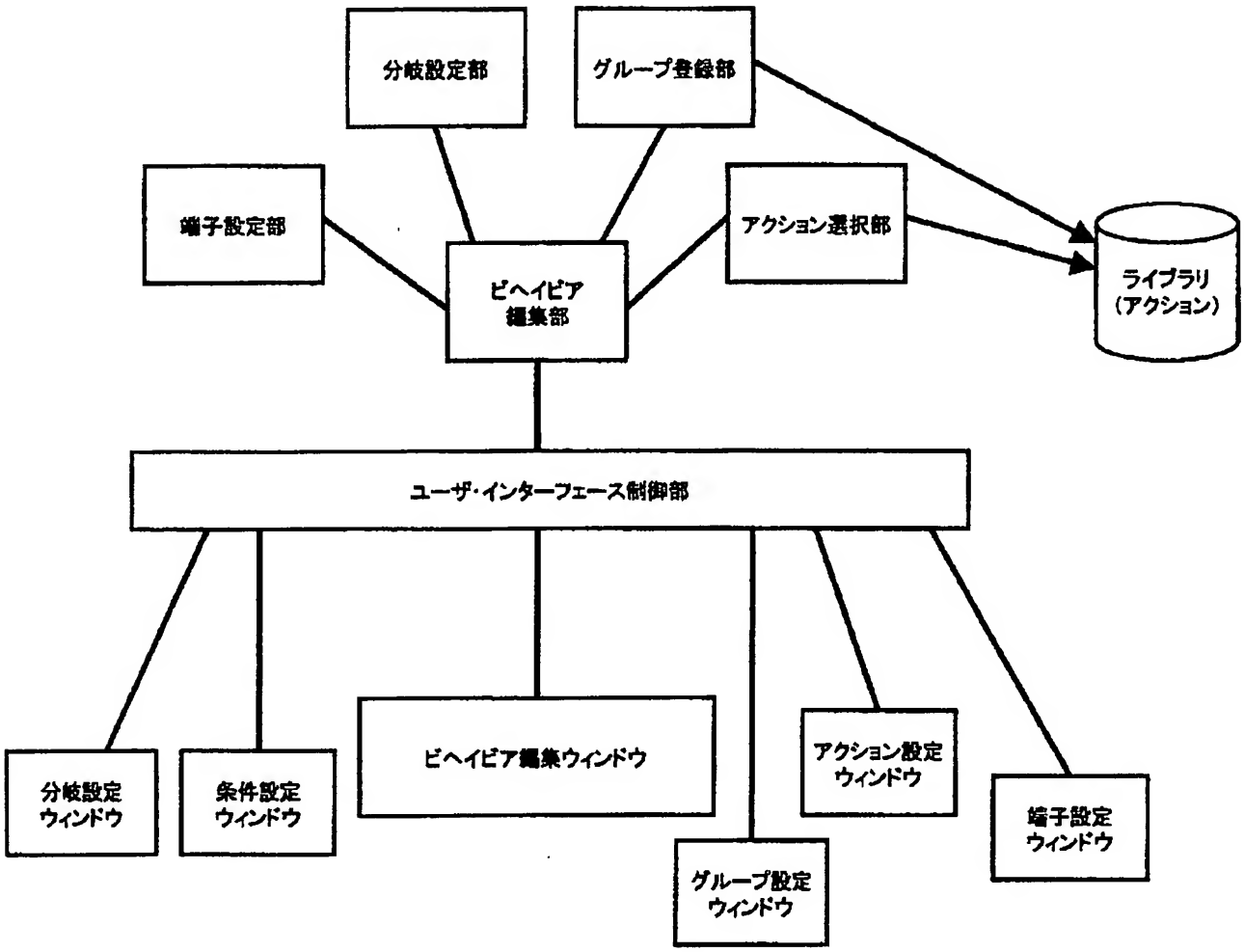
[Drawing 16]


3Dビュー
Preview_Window
04:60
カレント時刻
表示フィールド
フレーム
巻き戻し
前の
キーフレーム
再生
フレーム
コマ送り
フレーム
送り
ループ再生
ズームイン
／アウト
回転
パン
ホーム位置

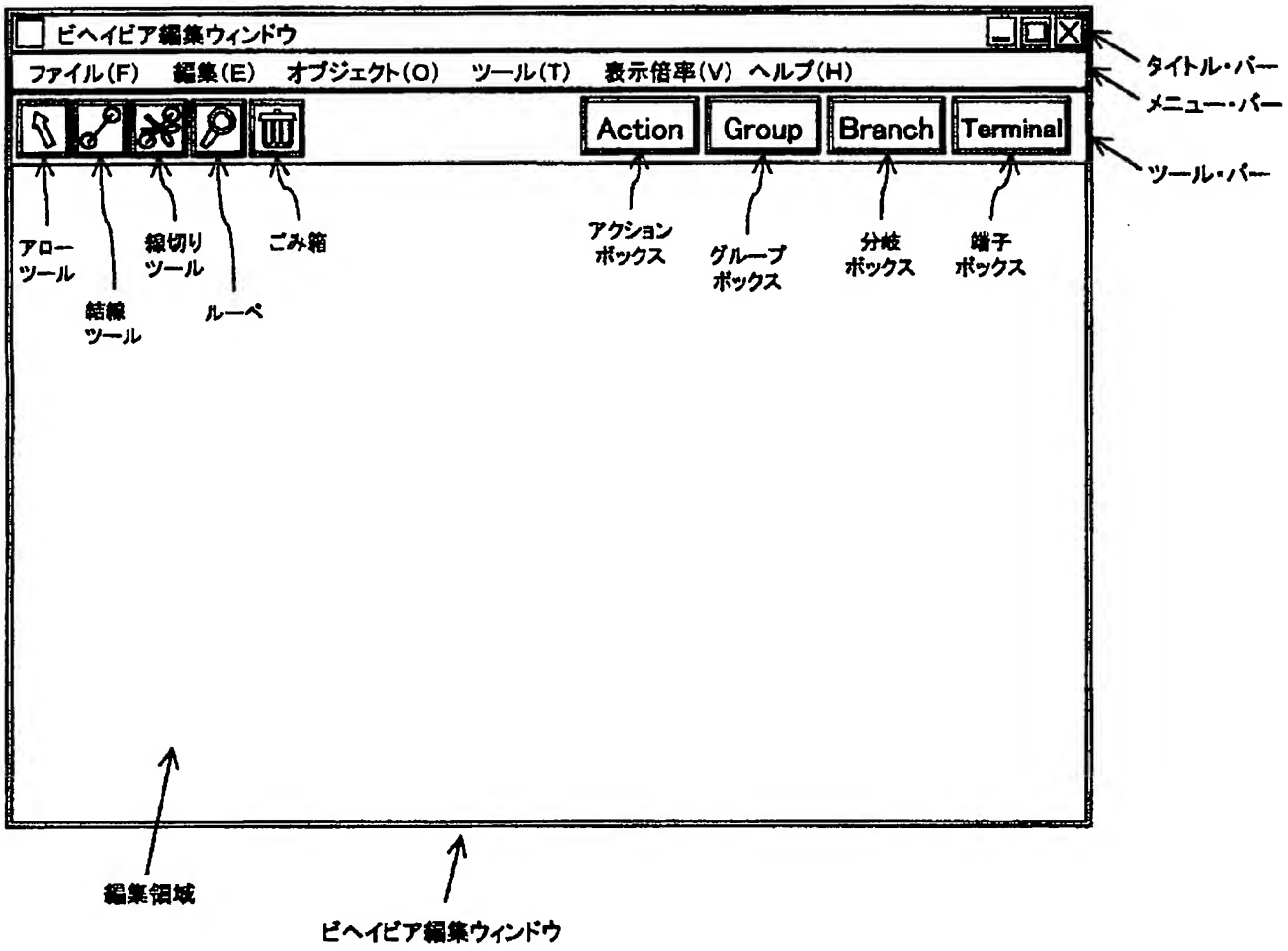
[Drawing 17]


表示切り替えポップアップ
実体指定領域
3D表示領域
Pose_Edit_Window
実体指定領域
3D表示切り
替えボタン群
頭部前後 45.00
頭部回転 0.00
頭部傾き 12.00
左前脚第一関節回転 175.00
左前脚第一関節前後 80.00
左前脚第二関節 72.35
右前脚第一関節回転 175.00
右前脚第一関節前後 83.54
右前脚第二関節 70.65
左後脚第一関節回転 190.23
左後脚第一関節前後 84.32
左後脚第二関節 113.02
右後脚第一関節回転 185.34
3D_view
リスト指定領域
OK
キャンセル
設定値領域

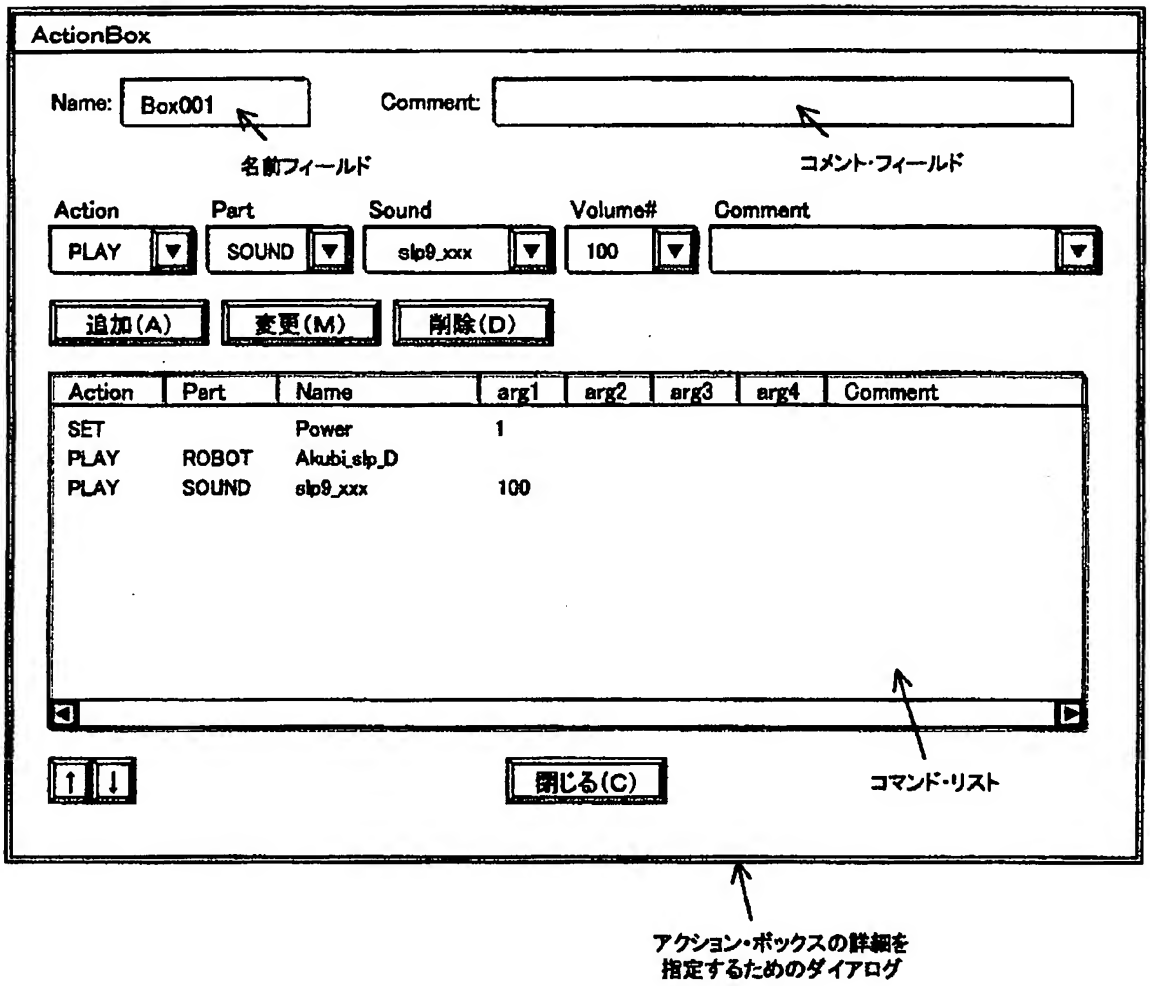
[Drawing 19]


分岐設定部
グループ登録部
端子設定部
ビヘイビア
編集部
アクション選択部
ライブラリ
(アクション)
ユーザ・インターフェース制御部
分岐設定
ウィンドウ
条件設定
ウィンドウ
ビヘイビア編集ウィンドウ
グループ設定
ウィンドウ
アクション設定
ウィンドウ
端子設定
ウィンドウ

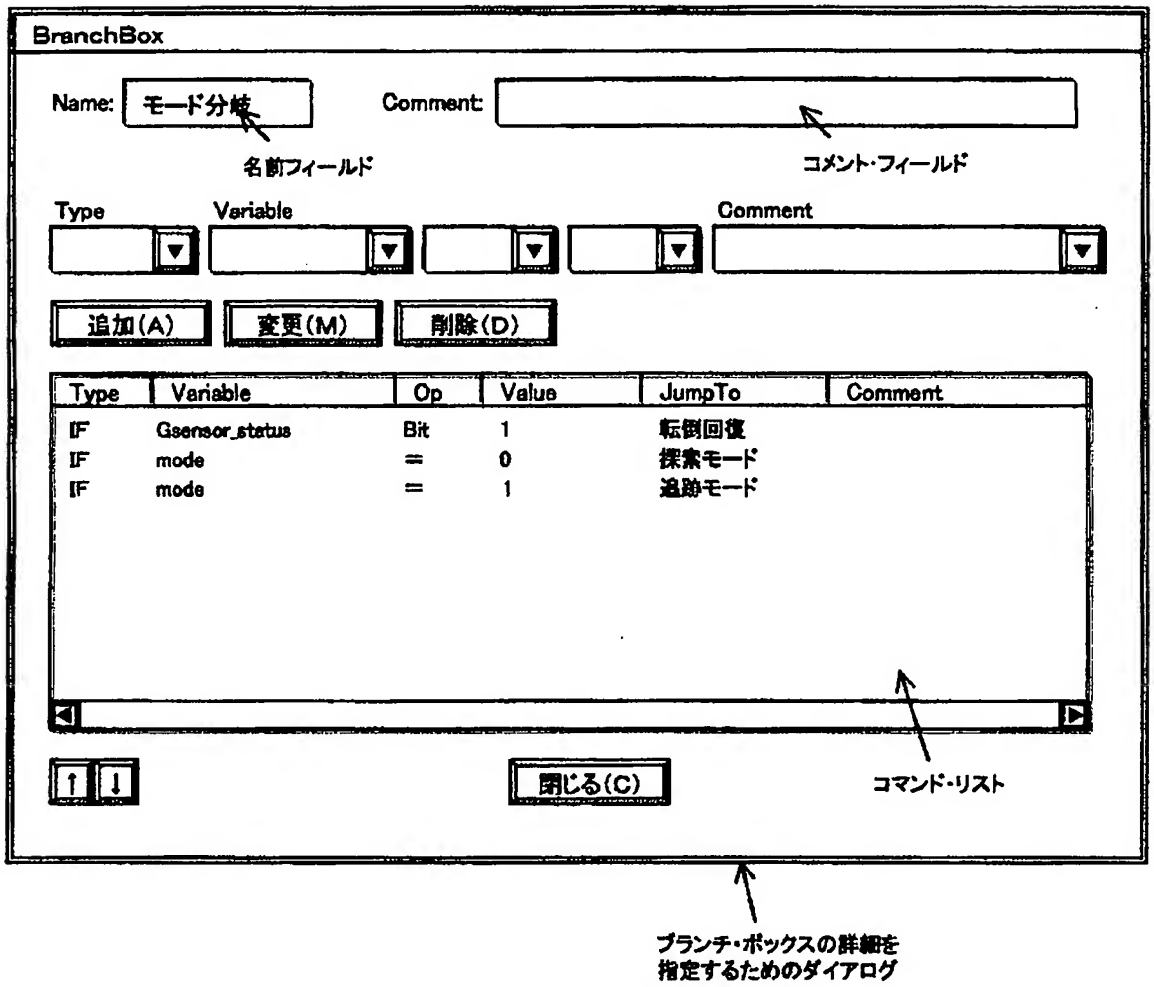
[Drawing 20]


ビヘイビア編集ウィンドウ
ファイル(F) 編集(E) オブジェクト(O) ツール(T) 表示倍率(V) ヘルプ(H)
Action
Group
Branch
Terminal
タイトル・バー
メニュー・バー
ツール・バー
アロー ツール
結線 ツール
線切り ツール
ルーペ
ごみ箱
アクション ボックス
グループ ボックス
分岐 ボックス
端子 ボックス
編集領域
ビヘイビア編集ウィンドウ

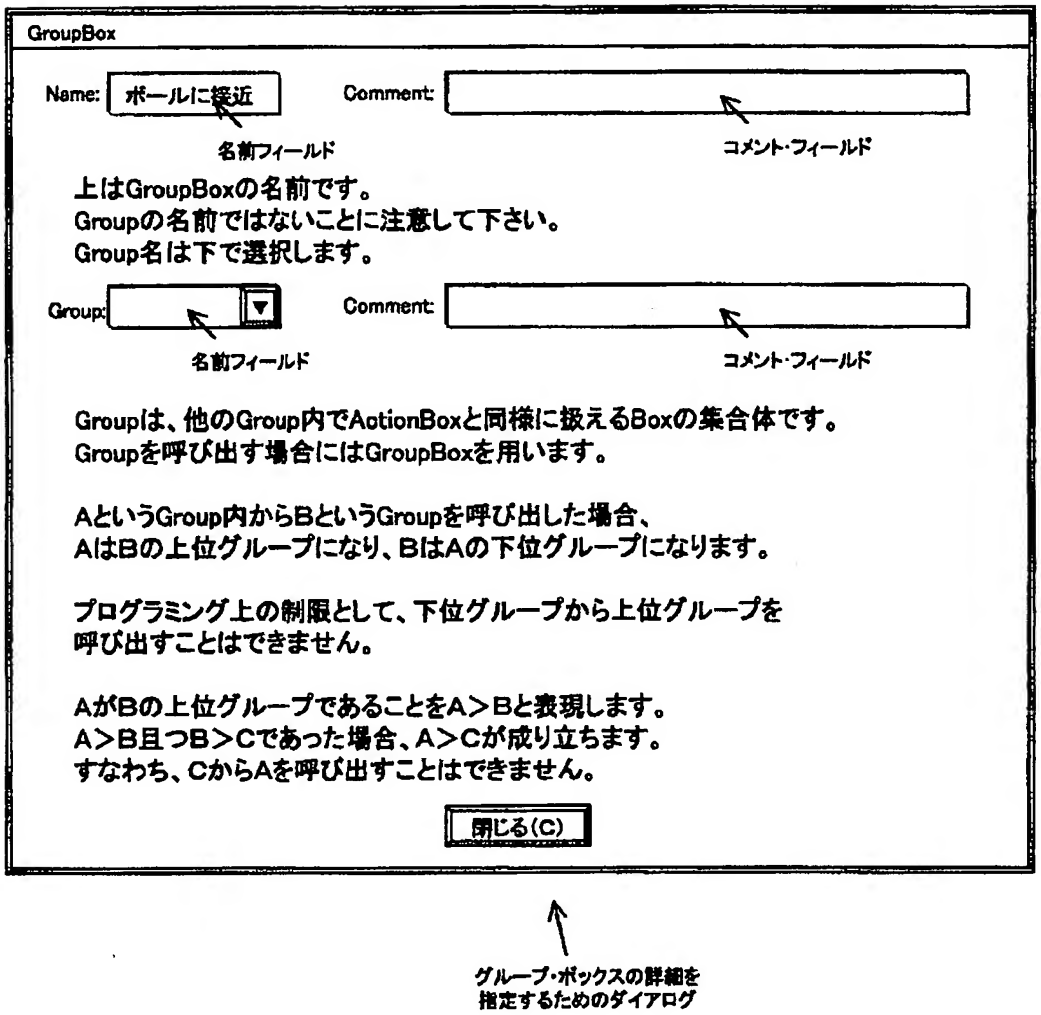
[Drawing 24]


ActionBox
Name:
Box001
Comment:
名前フィールド
コメント・フィールド
Action
Part
Sound
Volume#
Comment
PLAY
SOUND
slp9_xxx
100
追加(A)
変更(M)
削除(D)
Action
Part
Name
arg1
arg2
arg3
arg4
Comment
SET
Power
1
PLAY
ROBOT
Akubi_slp_D
PLAY
SOUND
slp9_xxx
100
閉じる(C)
コマンド・リスト
アクション・ボックスの詳細を
指定するためのダイアログ

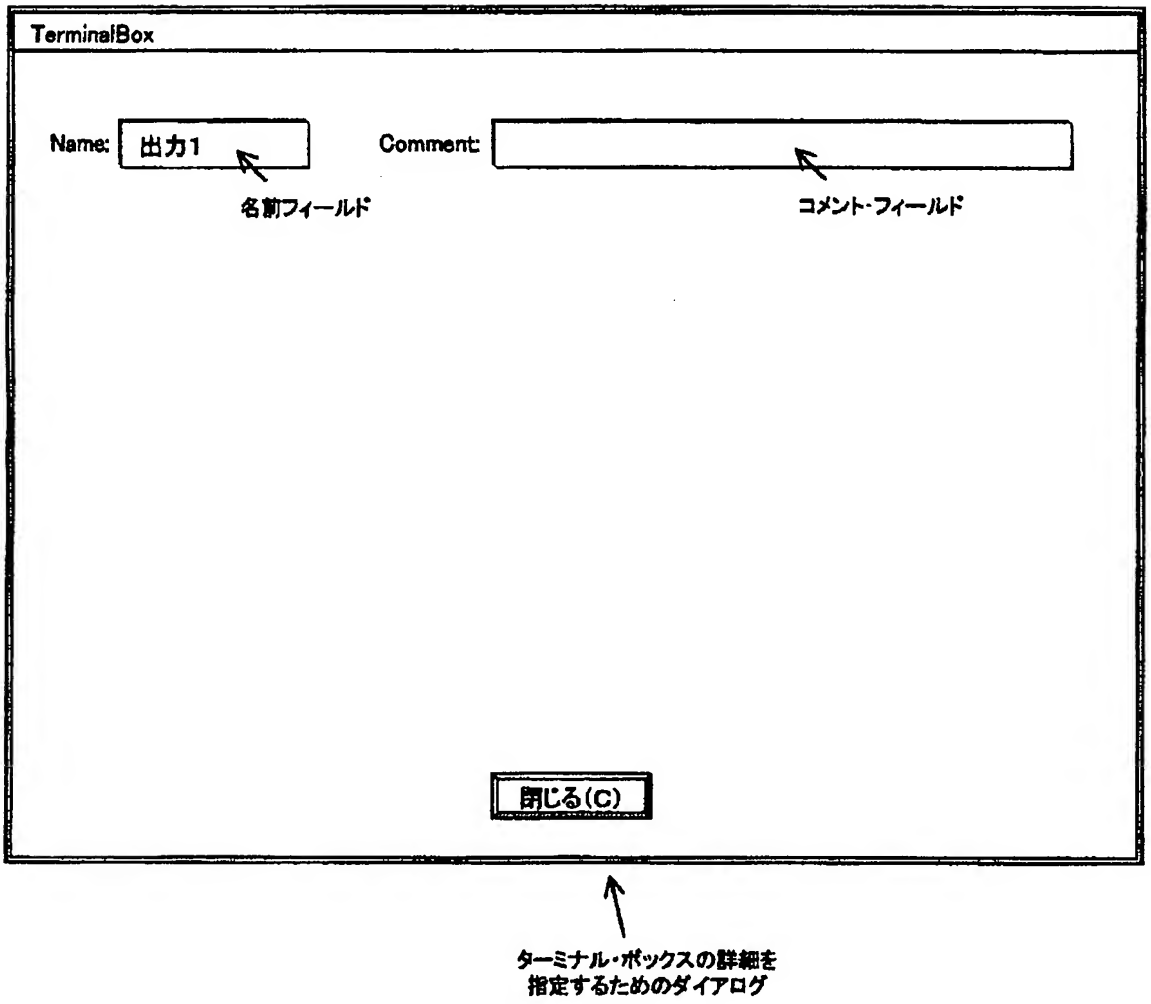
[Drawing 25]


BranchBox
Name:
モード分岐
Comment:
名前フィールド
コメント・フィールド
Type
Variable
Comment
追加(A)
変更(M)
削除(D)
Type
Variable
Op
Value
JumpTo
Comment
IF
Gsensor_status
Bit
1
転倒回復
IF
mode
=
0
探索モード
IF
mode
=
1
追跡モード
閉じる(C)
コマンド・リスト
ブランチ・ボックスの詳細を
指定するためのダイアログ

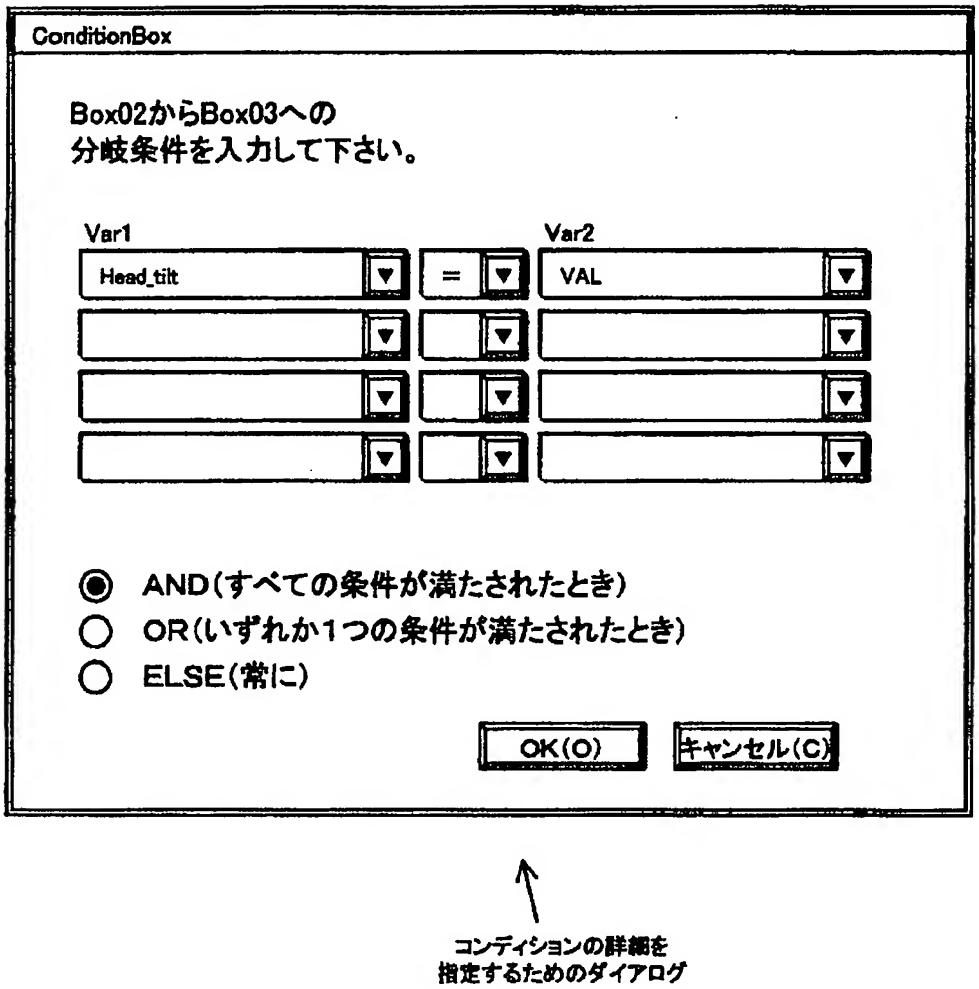
[Drawing 26]


GroupBox
Name: ボールに接近
Comment:
名前フィールド
コメント・フィールド
上はGroupBoxの名前です。
Groupの名前ではないことに注意して下さい。
Group名は下で選択します。
Group:
Comment:
名前フィールド
コメント・フィールド
Groupは、他のGroup内でActionBoxと同様に扱えるBoxの集合体です。
Groupを呼び出す場合にはGroupBoxを用います。
AというGroup内からBというGroupを呼び出した場合、
AはBの上位グループになり、BはAの下位グループになります。
プログラミング上の制限として、下位グループから上位グループを
呼び出すことはできません。
AがBの上位グループであることをA＞Bと表現します。
A＞B且つB＞Cであった場合、A＞Cが成り立ちます。
すなわち、CからAを呼び出すことはできません。
閉じる(C)
グループ・ボックスの詳細を
指定するためのダイアログ

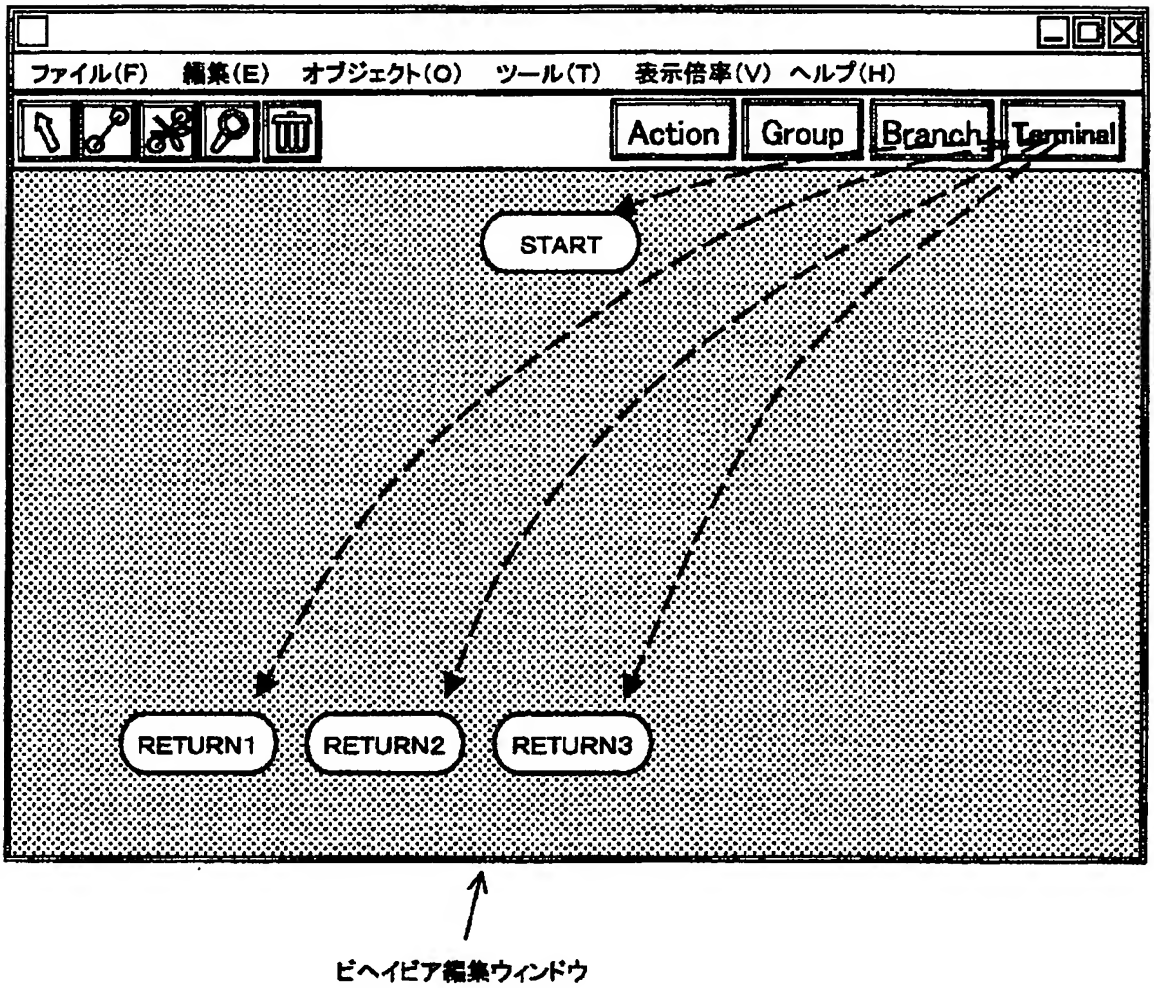
[Drawing 27]


TerminalBox
Name:
出力1
Comment:
名前フィールド
コメント・フィールド
閉じる(C)
ターミナル・ボックスの詳細を
指定するためのダイアログ

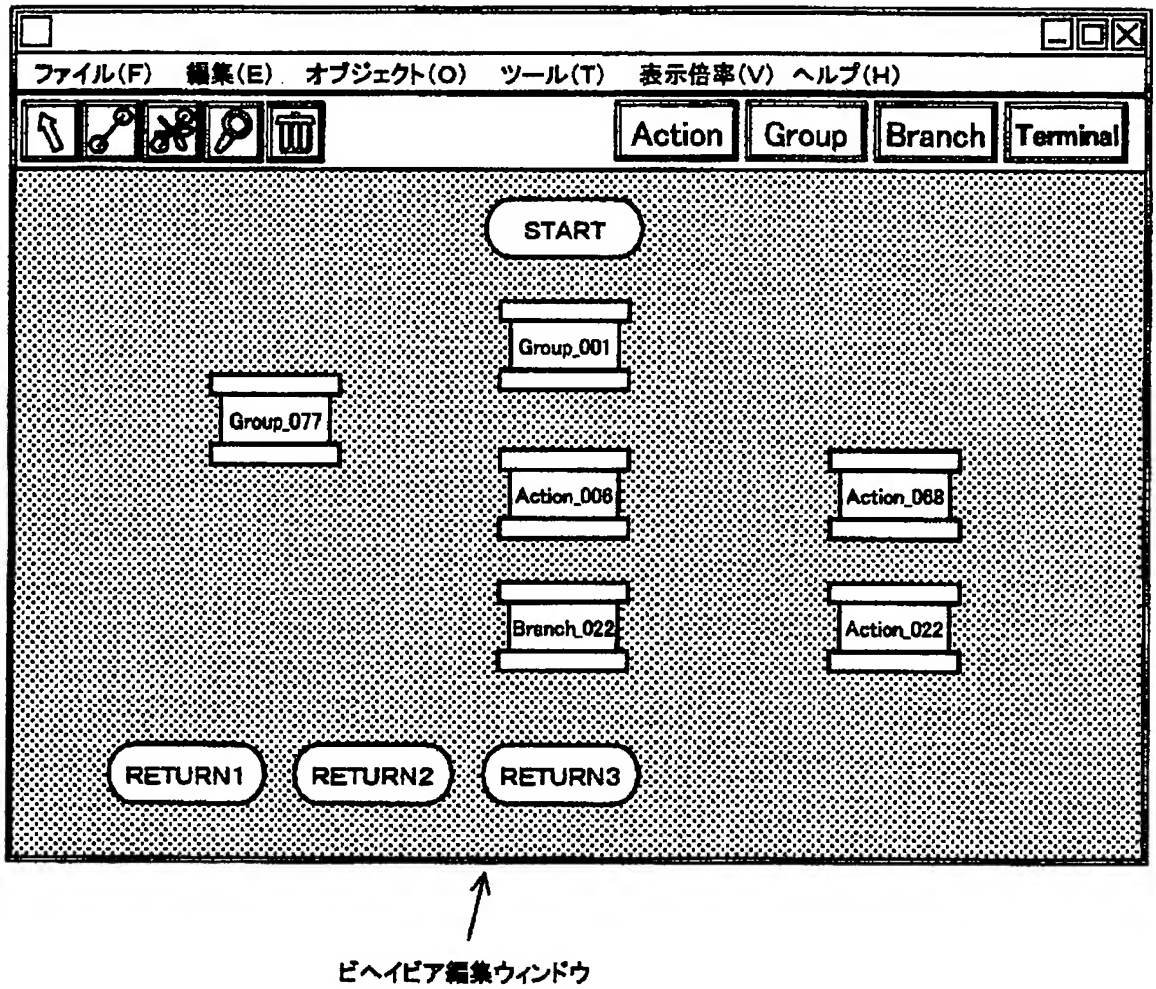
[Drawing 28]


ConditionBox
Box02からBox03への
分岐条件を入力して下さい。
Var1
Var2
Head_tilt
=
VAL
AND(すべての条件が満たされたとき)
OR(いずれか1つの条件が満たされたとき)
ELSE(常に)
OK(O)
キャンセル(C)
コンディションの詳細を
指定するためのダイアログ

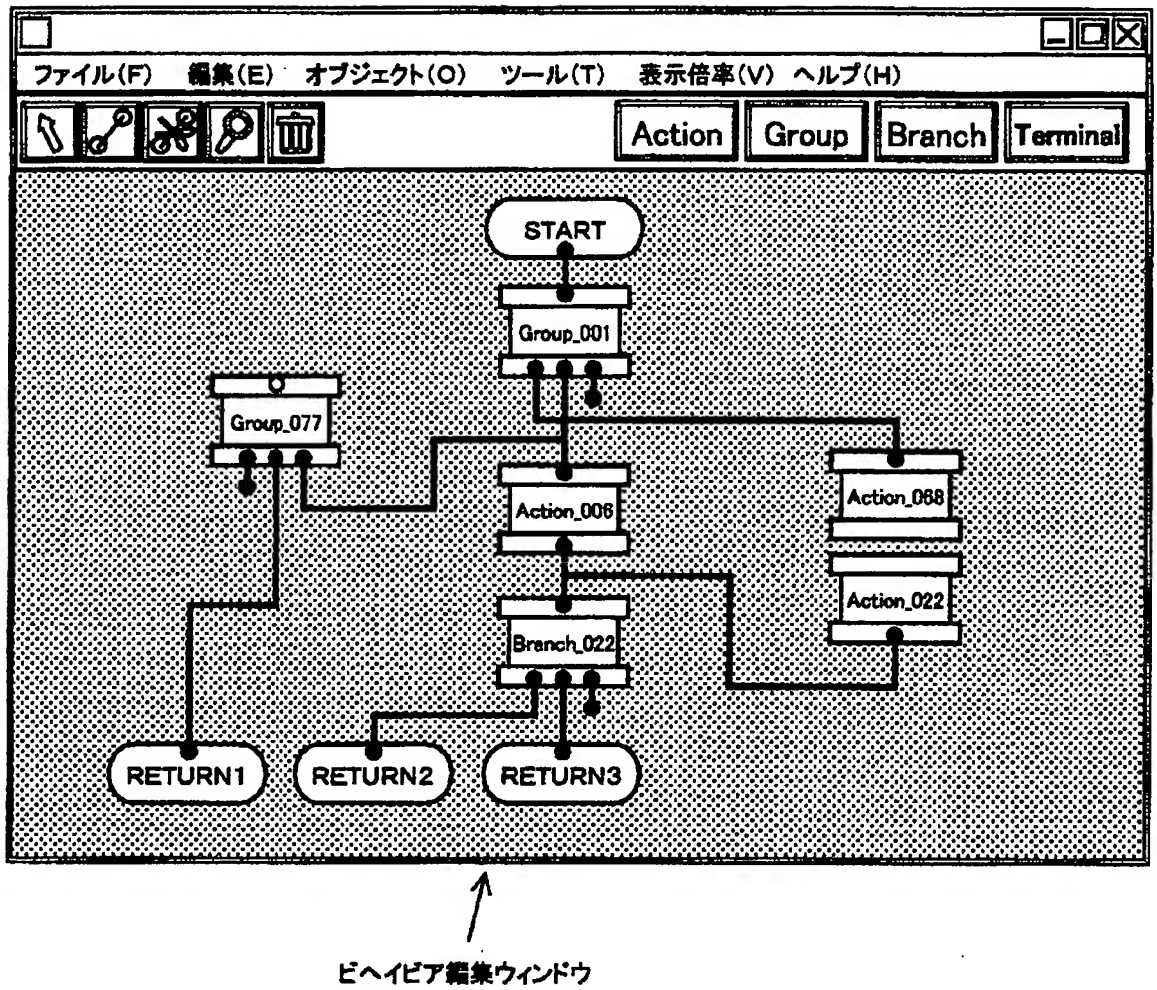
[Drawing 29]


ファイル(F) 編集(E) オブジェクト(O) ツール(T) 表示倍率(V) ヘルプ(H)
Action
Group
Branch
Terminal
START
RETURN1
RETURN2
RETURN3
ビヘイビア編集ウィンドウ

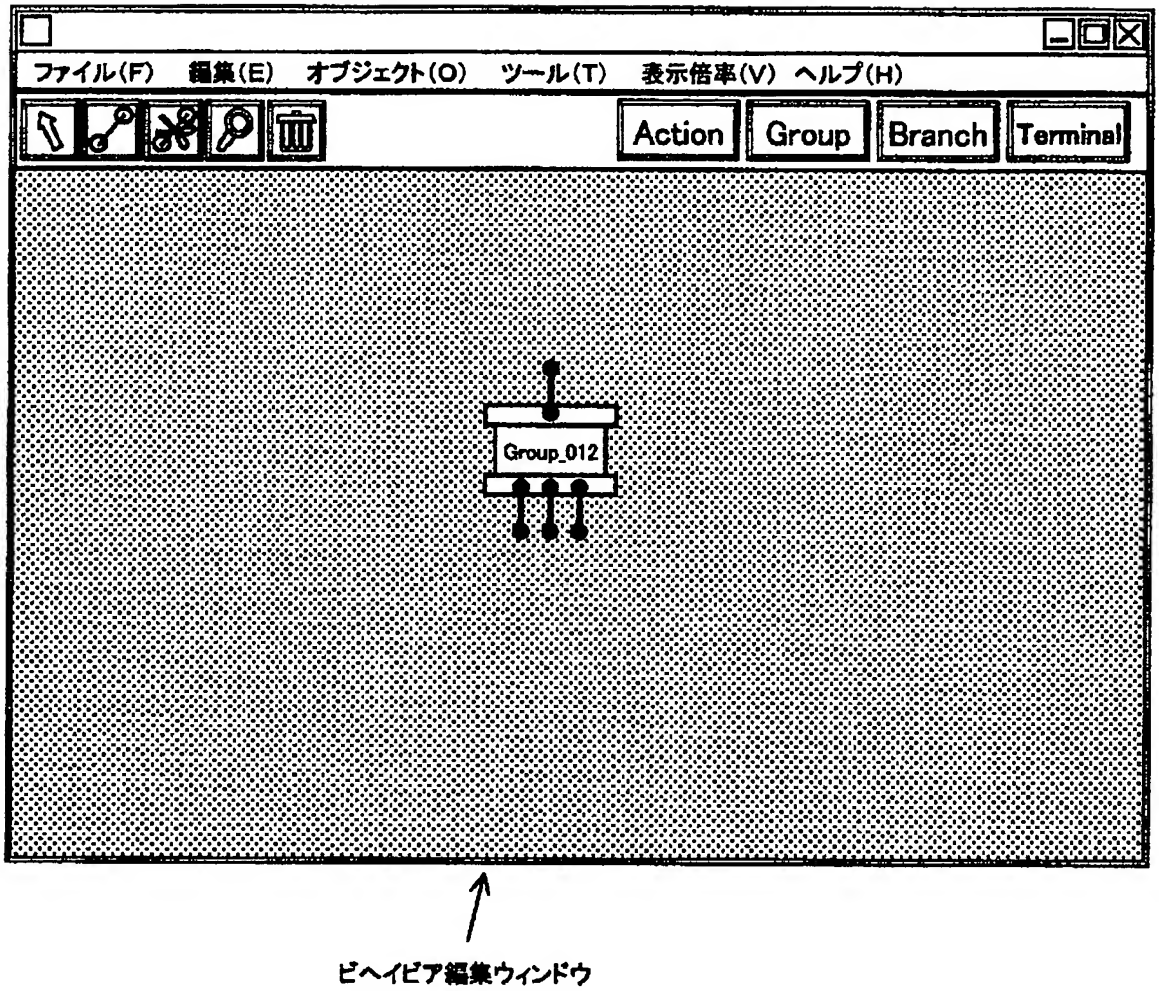
[Drawing 30]


ファイル(F)　編集(E)　オブジェクト(O)　ツール(T)　表示倍率(V)　ヘルプ(H)
Action
Group
Branch
Terminal
START
Group_001
Group_077
Action_006
Action_068
Branch_022
Action_022
RETURN1
RETURN2
RETURN3
ビヘイビア編集ウィンドウ

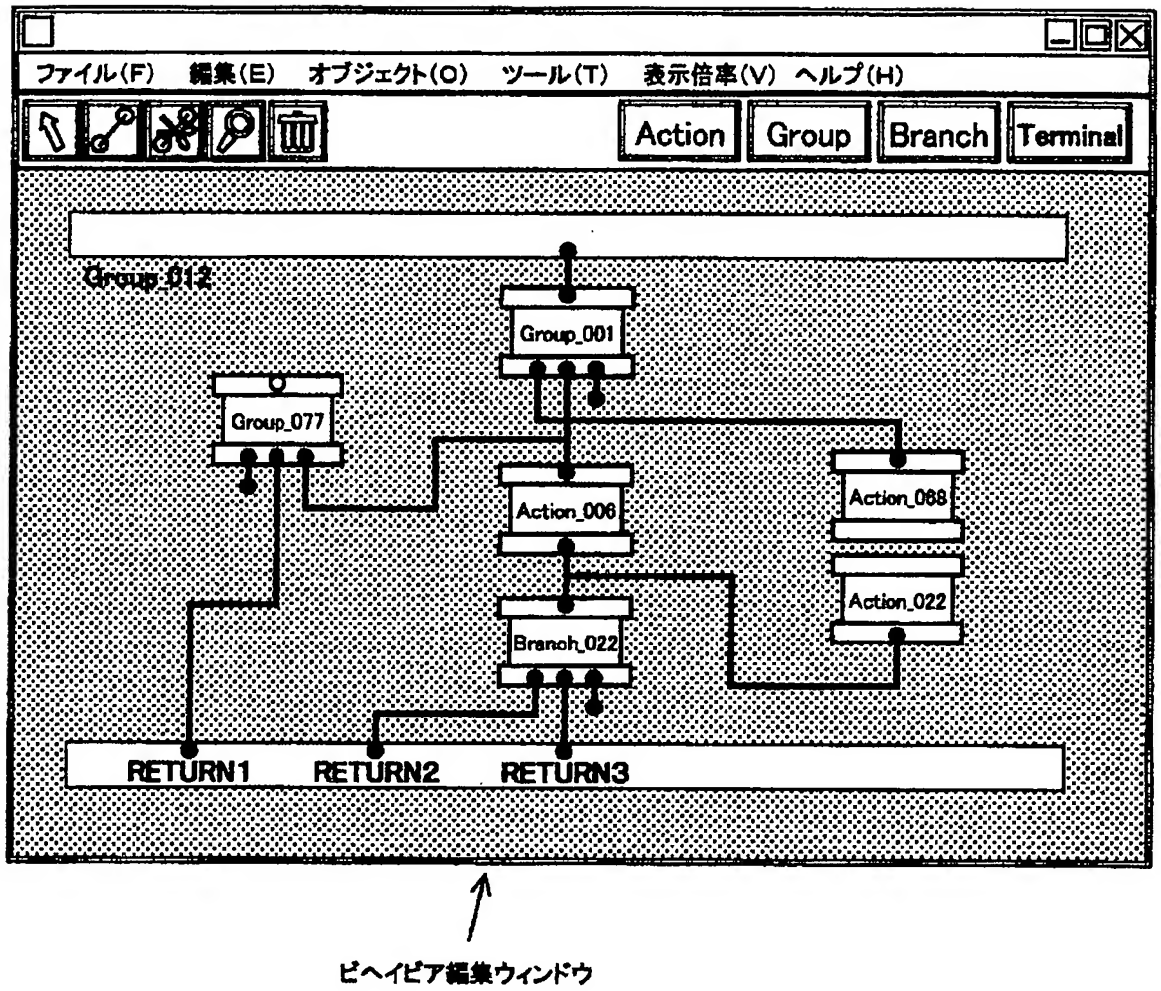
[Drawing 31]


ファイル(F)　編集(E)　オブジェクト(O)　ツール(T)　表示倍率(V)　ヘルプ(H)
Action
Group
Branch
Terminal
START
Group_001
Group_077
Action_006
Action_068
Action_022
Branch_022
RETURN1
RETURN2
RETURN3
ビヘイビア編集ウィンドウ

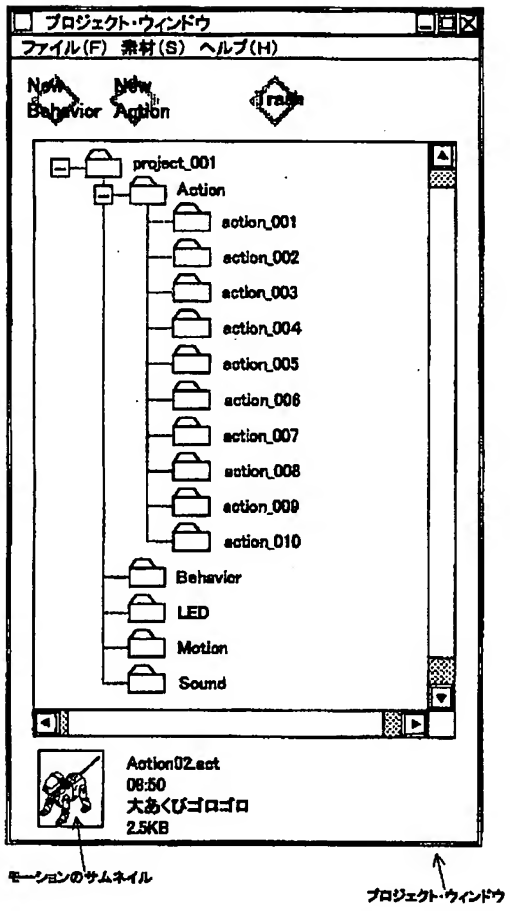
[Drawing 32]


ファイル(F) 編集(E) オブジェクト(O) ツール(T) 表示倍率(V) ヘルプ(H)
Action
Group
Branch
Terminal
Group_012
ビヘイビア編集ウィンドウ

[Drawing 33]


ファイル(F)　編集(E)　オブジェクト(O)　ツール(T)　表示倍率(V)　ヘルプ(H)
Action
Group
Branch
Terminal
Group_012
Group_001
Group_077
Action_006
Action_088
Action_022
Branch_022
RETURN1
RETURN2
RETURN3
ビヘイビア編集ウィンドウ

[Drawing 34]



[Translation done.]